5.0 ALTERNATIVES ANALYSIS

5.1 OVERVIEW

This chapter considers whether reasonable alternatives to the Project exist that offer substantial environmental advantages to the Project, while still being able to feasibly attain Duke Energy's basic Project objective. As described in Chapter 2.0 - Project Description, Duke Energy's basic Project objective is to provide efficient modernization of the Morro Bay Power Plant (MBPP) that results in continued power generation, at significantly higher efficiency, while utilizing existing infrastructure (e.g., existing transmission lines, utilities, water intake and outfall structures) and minimizing environmental effects. In addition, Duke Energy is seeking a project that substantially improves the local environment for the residents of the City of Morro Bay and surrounding areas given the close proximity of the town to the power plant site.

Selection of alternatives for consideration in this analysis is governed by the rule of reason, which requires an environmental document to "set forth only those alternatives necessary to permit a reasoned choice" (California Code of Regulations [CCR] Title 14, Section 15126.6[f]). The key issue is whether the selection and discussion of alternatives fosters informed decision-making and public participation based on the various economic, environmental, social and technological factors involved. An environmental document need not consider an alternative where the effect cannot be reasonably ascertained and where implementation is remote and speculative (CCR Title 14, Section 15126.6[f][3]).

Consequently, for purposes of this analysis, the reasonable range of alternatives is: (1) the original Application for Certification (AFC) filed in August 1999 where Units 3 and 4 continue to operate and Units 1 and 2 are replaced by a new 500 megawatt (MW) combined-cycle facility; (2) following the Memorandum of Understanding (MOU) as agreed to by the City of Morro Bay and Duke Energy where Units 1 and 2 will be shut down as soon as the first combined cycle unit is installed and then, Units 3 and 4 will be shutdown by 2010 once the second combined-cycle is installed; (3) alternative onsite locations for the new combined cycle units; and (4) not developing the Project at all, i.e., the No Project alternative. In addition, alternatives related to new unit structure alternatives; alternative generating technologies; and alternative cooling technologies are presented.

Under California Energy Commission (Commission) statutes (California Public Resources Code [PRC] Sections 25540.6[a][2] and 25540.6[b]), modification of an existing facility is exempt from the requirement to file a notice of intent, as well as the requirement to consider offsite alternatives. As described in Section 5.2, because the Project involves optimizing use of the existing MBPP site and its infrastructure, offsite alternatives for MBPP would necessarily result in substantial new environmental impacts. This is because any new site would require construction of new power plant related facilities such as: cooling water systems; 230 kilovolt (kV) transmission lines for interconnection to the regional and statewide electric grid; natural gas pipelines to provide fuel; and additional related infrastructure (e.g., roads, utility connects). Modernization of an existing power plant facility would avoid these new impacts. The reduced environmental impacts associated with onsite expansion of MBPP are discussed in detail in Section 5.2.

Alternatives considered in this analysis are described and evaluated in the sections below. A comparative analysis of alternatives follows the separate evaluations and is summarized in Table 5-1. Overall conclusions are then provided to complete the analysis. The remainder of this chapter is organized as follows:

- Decreased Environmental Impacts From Locating the Project at MBPP
- Units 3 and 4 Continue to Operate - New 530 MW Combined-Cycle Installed
- No Project Alternative
- Alternative Onsite Configurations
- Accelerated Replacement of the MBPP site (the Project)
- New Units Structure Alternatives
- Alternative Cooling Technologies
- Alternative Generating Technologies
- Comparative Analysis of Alternatives
- Conclusions

5.2 DECREASED ENVIRONMENTAL IMPACTS FROM LOCATING THE PROJECT AT MORRO BAY POWER PLANT

The Project is a modernization of an existing facility. As a result, the Project is exempt from the notice of intent requirements in PRC Section 25540.6(a) and, due to its strong relationship to the existing industrial site, the Project is also exempt from the alternative site discussion requirements of PRC Section 25540.6(b). Nevertheless, certain additional and unique attributes of the Project location are worthy of note, and are described in the following paragraphs.

The Project is designed to optimize use of the existing power plant and appurtenant structures. As a result, the Project is, by definition, directly and strongly associated with the existing MBPP and provides for continued and enhanced productive use of existing industrial infrastructure at the site.

TABLE 5-1

COMPARATIVE ANALYSIS OF ALTERNATIVES
MORRO BAY POWER PLANT MODERNIZATION

ALTERNATIVES	FEASIBILITY CRITERIA			ENVIRONMENTAL IMPACT CRITERIA																
	Cost	Commercial Availability	Operational Compatibility	Air Quality	Geology Hazards	Agriculture and Soils	Water Resources	Biological Resources	Cultural Resources	Paleontological Resources	Land Use	Socioeconomics	Traffic and Transportation	Noise	Visual Resources	Waste Management	Hazardous Materials	Public Health	Worker Safety	Transmission System Safety and Nuisance
THE PROJECT																				
• Configuration 1 Conventional Combined Cycle Technology - Accelerated Replacement of Existing Units	Low	High	High	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Moderate	Moderate	Low	Low	Low
ONSITE ALTERNATIVE																				
• Units 3 and 4 Continue to Operate - New 530 MW Unit	Low	High	High	●	✲	✲	●	●	✲	✲	✲	✲	✲	●	●	✲	✲	✲	✲	✲
COMPARATIVE IMPACTS																				
NO PROJECT	Low	High	High	●	✲	✲	●	●	✲	✲	✲	✲	✲	●	●	✲	✲	✲	✲	✲
ALTERNATIVE ONSITE CONFIGURATION																				
• Alternative Configuration 2	Low	High	High	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲
• Alternative Configuration 3	Low	High	High	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲
• Alternative Configuration 4	Low	High	High	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲
ALTERNATIVE COOLING TECHNOLOGIES																				
• Mechanical Draft Seawater Cooling Tower	High	High	Moderate	✲	✲	✲	✲	✲	✲	✲	●	✲	✲	●	●	✲	✲	✲	✲	✲
• Natural Draft Cooling Tower	High	High	Moderate	✲	✲	✲	✲	✲	✲	✲	●	✲	✲	●	●	✲	✲	✲	✲	✲
• Air-Cooled Condenser	High	High	Moderate	✲	✲	✲	✲	✲	✲	✲	●	✲	✲	●	●	✲	✲	✲	✲	✲
• Cooling Ponds	Moderate	High	Low	✲	✲	✲	●	❍	✲	✲	●	✲	✲	✲	●	●	✲	✲	✲	✲
• Variable Speed Pump Motors	Moderate	High	High	✲	✲	✲	✲	❍	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲
• Lower Delta T to 15° F	High	Moderate	Low	✲	✲	✲	❍	❍	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲
• Cooling Water Discharge Relocation	High	High	High	✲	✲	✲	●	●	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲
• Discharge Pump Diversion Jetty	High	High	High	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	●	✲	✲	●	✲	✲
• Offshore Cooling Water Intake	High	High	High	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	●	✲	✲	✲	✲	✲
• Additional Modifications	Moderate	High	High	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	●	✲	✲	✲	✲	✲
ALTERNATIVE GENERATING TECHNOLOGIES																				
• Oil and Natural Gas																				
- Conventional Boiler-Steam/Turbine	Moderate	High	High	●	✲	✲	●	✲	✲	✲	✲	✲	✲	✲	●	✲	●	✲	✲	✲
- Supercritical Boiler/Steam/Turbine	Moderate	High	High	●	✲	✲	●	✲	✲	✲	✲	✲	✲	✲	●	✲	●	✲	✲	✲
- Simple Combustion Turbine	Moderate	High	High	●	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲
- Kalina Combined Cycle	Moderate	Low	Moderate	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	●	✲	✲	✲
- Advanced Gas Turbine Cycles	High	Low	Moderate	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲
- Fuel Cells	High	Low	Moderate	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲
• Coal																				
- Conventional Furnace/Boiler Steam Turbine/Generator	Moderate	High	Moderate	●	✲	●	●	✲	✲	✲	●	✲	●	●	✲	●	●	●	●	✲
- Atmospheric and Pressurized Fluidized Bed Combustion	Moderate	Moderate	Moderate	●	✲	●	●	✲	✲	✲	●	✲	●	●	✲	●	●	●	●	✲
- Integrated Gasification Combined Cycle	Moderate	Low	Moderate-High	●	✲	●	●	✲	✲	✲	●	✲	●	●	✲	●	●	●	●	✲
- Direct and Indirect Fuel Combustion Turbines	High	Low	Low	●	✲	●	●	✲	✲	✲	●	✲	●	●	✲	●	●	●	●	✲
- Magnetohydrodynamics	High	Low	Low	●	✲	●	●	✲	✲	✲	●	✲	●	●	✲	●	●	●	●	✲
• Nuclear Reactions	High	Moderate	Low	●	●	●	●	✲	✲	✲	●	✲	✲	●	●	●	●	●	●	✲
• Water																				
- Hydroelectric	High	High	Low	❍	✲	●	●	●	✲	✲	●	✲	✲	●	●	✲	✲	✲	✲	✲
- Geothermal	High	Low	Low	❍	●	●	✲	✲	✲	✲	✲	✲	✲	✲	✲	●	✲	✲	✲	✲
- Ocean Energy Conversion	High	Low	Low	❍	✲	✲	●	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲
• Biomass	High	High	Low	●	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	●	✲	✲	✲	✲
• Municipal Solid Waste	High	Moderate	Low	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	✲	●	✲	✲	✲	✲
• Solar Radiation																				
- Solar Thermal	High	Moderate	Low	❍	✲	●	❍	✲	✲	✲	●	✲	❍	❍	●	✲	❍	✲	✲	✲
- Solar Photovoltaic	High	Moderate	Low	❍	✲	●	❍	✲	✲	✲	●	✲	❍	❍	●	✲	❍	✲	✲	✲
- Wind Generation	High	Moderate	Low	❍	✲	●	❍	✲	✲	✲	●	✲	❍	❍	●	✲	❍	✲	✲	✲

98-710/Rpts/AFC(text)/Tbls&Figs (10/21/00/rm)

LEGEND: ❍ = Less Impact; ✲ = Same or Similar Impact; ● = Greater Impact.

Specific examples of the use of existing resources at MBPP by the Project include:

- Using land-zoned coastal dependent industrial (M-2) and currently occupied by the onsite fuel oil tanks.
- Using existing cooling water intake structures.
- Using existing cooling water discharge structures.
- Connecting to and using available capacity on adjacent existing Pacific Gas and Electric (PG&E) switchyard.
- Connecting to and using available capacity of existing transmission lines extending from the PG&E switchyard.
- Connecting to and using available adjacent existing natural gas supply lines.
- Employing existing Maintenance Facility and staff.
- Employing existing Administrative Facility and staff.
- Employing existing Engineering Facility and staff.
- Connecting to existing communication facilities.
- Connecting to an existing fire water system.
- Connecting to an existing septic system.
- Using an existing potable water system.
- Using an existing nonpotable water system.
- Using an existing oily water separator system.

Optimization of the Project within the existing MBPP also avoids new environmental impacts that would be associated with development at another site. This is recognized by the California Coastal Act (CCA), the City of Morro Bay General Plan, the City of Morro Bay Coastal Land Use Plan, and the Energy Elements of San Luis Obispo County's General Plan and the San Luis Obispo County Local Coastal Program.

The MBPP was constructed in the early 1950s. The facility was and is considered coastal dependent because it requires access to seawater for cooling purposes. As a result, MBPP qualifies as a coastal dependent facility as defined by CCA. Furthermore, in 1978, the California Coastal Commission (CCC) prepared a report pursuant to Section 30416(b) of the CCA, concluding that MBPP is not inappropriate for a power plant. The Commission agreed with this determination and also concluded in 1978 that the existing MBPP is a suitable site for power plant expansion (Opportunities to Expand Coastal Power Plants in California, 1980).

City of Morro Bay local policies and plans also encourage onsite development. The Morro Bay General Plan, Program LU-40.15, states that "[a]ny expansion of the PG&E [now Duke Energy] power plant shall give priority to the options that would best utilize available onsite space." The Morro Bay Coastal Land Use Plan, which has been certified by the CCC as the Local Coastal Program (LCP) for this region, similarly states that:

- Power plant expansion on PG&E [now Duke Energy] owned property shall have priority over other coastal-dependent industrial uses.

- Any expansion of the PG&E [now Duke Energy] power plant shall give priority to the options that would best utilize available onsite space. (Morro Bay Coastal Land Use Plan, Policies on Energy-Related Development, Policies 5.01 and 5.20.)

The San Luis Obispo County Energy Element and the San Luis Obispo County Local Coastal Program each state, in identical language, that "[w]hen new sites are needed for industrial or energy-related development, expansion of facilities on existing sites (or on land adjacent to existing sites) shall take priority over opening up additional areas or the construction of new facilities" (Energy Element, San Luis Obispo General Plan, Policy 58; Land Use Element, Local Coastal Program, San Luis Obispo General Plan, policies for energy and industrial development, Policy 1).

Further, the County's Local Coastal Plan quotes the CCA, stating that "[c]oastal-dependent industrial facilities shall be encouraged to locate or expand within existing sites" (CCA Section 30260). In addition, CCA recognizes expansion of coastal-dependent, electrical generating facilities as a preferred land use, provided certain conditions are met (PRC Section 30264). The CCA defines coastal dependent development or use as "any development or use which requires a site on or adjacent to the sea to be able to function at all" (PRC Section 30101).

As implied in the above policies, developing the same sized power generation capability as planned for the MBPP modernization at another location would make it difficult to avoid new environmental impacts. Key criteria required for reasonable selection of an offsite alternative would include:

- For a coastal location, a potential alternative site would have to be among those areas identified by the CCC in 1978 as a location that is not inappropriate for a power plant pursuant to Section 30416(b) of the CCA.
- The potential alternative site would also have to be among those areas identified in 1978 by the Commission as suitable for a power plant.
- The potential alternative site would have to be zoned or be capable of being rezoned "Heavy Industrial" or "Coastal Dependent Industrial."
- The site would have to be large enough to support construction of a 1,20 MW generating facility.
- The site would need to have sufficient existing infrastructure, or access thereto within a reasonable distance, to support a 1,200 MW generating facility. This would include:
    - Natural gas pipelines (20-inch or larger).
    - Major roads to support deliveries and operations.
    - Water for utilities and cooling (e.g., ground water, wastewater treatment facility effluent).
    - Reasonable proximity to an existing transmission line system to facilitate connecting transmission lines and switching facilities (230-kV or higher and with the capacity for the new plant).

Based on these criteria, new environmental impacts associated with the disturbance of offsite alternatives would be inevitable, including construction of new transmission lines, water and natural gas pipelines. An offsite alternative would also create new sources of visual, noise, traffic and land-use impacts. By contrast, only minimal upgrading of the existing MBPP once-through cooling seawater system intake and discharge structures will be required for the Project (see Chapter 8.0 - Engineering). This will avoid substantial new effects to the Morro Bay ecosystem, such as would occur through creation of new cooling water structures required for an alternative site. The use of seawater is an advantage of MBPP compared to inland sites that may use fresh water for cooling because it allows the facility to maximize the efficiency of its electrical output and avoid placing additional demand on the state's precious fresh water resources. In these ways, continued, productive use of the existing MBPP facilities is an efficient way to avoid significant new offsite environmental impacts.

In conclusion, development of an offsite alternative would create greater new impacts in the Morro Bay area or the overall County than simply modernization of MBPP. For these reasons, offsite alternatives are not discussed in this Application for Certification (AFC), consistent with PRC Sections 25540.6(a) and (b).

5.3 UNITS 3 AND 4 CONTINUE TO OPERATE - NEW 530 MW COMBINED-CYCLE INSTALLED

This alternative was the Project as defined in the August 1999 AFC filed by Duke Energy. In the August 1999 AFC, Duke Energy proposed the construction of a combined cycle unit at MBPP with a total capacity of 530 MW along with the continued use of the existing Units 3 and 4 indefinitely. Although the existing Units 1 through 4 at MBPP are competitive in the California energy market, the City of Morro Bay sought the complete and early demolition of the existing units as a condition of its support for the modernization Project. Recognizing the importance of the City of Morro Bay's support, and recognizing the improvement to the viewsheds in the local community with the early removal of the existing power building and stacks, Duke Energy agreed to withdraw the August 1999 AFC in October 1999.

Through an extensive review by Duke Energy and the City of Morro Bay of how to improve the site, the City of Morro Bay and its residents have fundamentally shaped the specific features of the MBPP modernization effort. Through diligent efforts by the City of Morro Bay and Duke Energy, the present Project - the subject of this AFC - is an outstanding example of community planning and participation. Based on the process between the City of Morro Bay and Duke Energy, this alternative has been eliminated in favor of the present Project.

5.4 NO PROJECT ALTERNATIVE

The No Project alternative is defined simply as status quo for the existing MBPP[(1)]. Power generation would continue, based on the older, less efficient 1950s and 1960s technology currently operating at MBPP. Continued operation of Units 1 through 4 would have two notable effects. First, greater environmental effects would result from continued operation of older power plant technology at Morro Bay. Air emissions of ozone precursors, PM_{10} precursors and carbon monoxide from the power plant in the Morro Bay area would be the same or greater, noise from the louder existing technology (especially Units 1 and 2) would continue to be notable throughout the community at night, and greater amounts of cooling water per MW-hour of energy produced would be required to be withdrawn from Morro Bay than is required for the proposed modern power generation units.

A second notable effect of continued operation of older MBPP technology would be less efficient power generation. Less efficient power generation means higher energy production costs, resulting in greater costs to electricity ratepayers (i.e., the energy-buying public). This lost efficiency would have an adverse economic effect due to higher costs to California consumers. This effect is more notable in 2000 with the more than doubling of natural gas prices from 1999.

Another potential effect of less efficient power generation at MBPP is reduced reliability during periods of high demand. With the recent improvement in California's economy, and the continued growth in California, it is expected that high power demand will be a more normal circumstance in California. Under the No Project Alternative, not only would more efficient power generation of MBPP be unavailable, but increased power generation capability from the modernized MBPP would also be unavailable. Again, this could give rise to the need to import power which, during higher demand periods, can result in higher costs or, in unusually high demand periods, may not always be available.

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(1) The "no project" analysis shall discuss the existing conditions at the time … the environmental analysis is commenced, as well as what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure…

If the project is other than a land use or regulatory plan, for example a development project on identifiable property, the "no project" alternative is the circumstance under which the project does not proceed. Here the discussion would compare the environmental effects of the property remaining in its existing state against environmental effects which would occur if the project is approved. If disapproval of the project under consideration would result in predictable actions by others, such as the proposal of some other project, this "no project" consequence should be discussed. In certain instances, the no project alternative means "no build" wherein the existing environmental setting is maintained. However, where failure to proceed with the project will not result in preservation of existing environmental conditions, the analysis should identify the practical result of the project's non-approval and not create and analyze a set of artificial assumptions that would be required to preserve the existing physical environment. (14 CCR 15126.6(e)(2)).

Under the No Project Alternative, the existing Units 1 through 4 at MBPP would be required to meet stringent new air emission levels restriction. By adding selective catalytic reduction (SCR) these requirements can be met. SCR will also be used by the Project to control emissions; however, under the No Project Alternative, larger onsite storage quantities of ammonia would be required and add to an increase in transport and storage of hazardous materials at the existing site. The SCR retrofit technology for boilers requires more ammonia and results in higher emissions than the SCR technology developed for combined cycle units. The Project's new combined cycle units will also offer better emission rates than the SCR renovation of Units 1 through 4, renovated with SCR.

Without the increased power generation capability of the new units at MBPP, regional demand for electricity would continue to be placed on older, less efficient power plants with older power generating technology, such as MBPP Units 1 through 4 (which would be replaced by the Project). As described above, use of older power plant facilities means increased environmental impacts. The Project also provides an additional 198 MW of power. If the Project is not built, another facility would need to generate the additional 198 MW.

Addition of small modern power generation plant at another location would result in the need to either: (1) modify an existing nonpower plant industrial facility in the area to facilitate development of a power plant; (2) install additional generation at another existing power plant in the form of upgrades, replacements or additional units, including peakers; or (3) begin an entirely new power plant development on an open piece of property (i.e., typically referred to as a greenfield site). Any of these eventualities could result in increased environmental impacts to the region due to development of a greenfield site, installation of less efficient peaking units or construction of an additional power generation facility. None of these alternatives would improve the environment in Morro Bay. As described in Section 5.2, above, modernization of MBPP is a very efficient use of regional industrial facilities and energy resources and would improve the environment in Morro Bay.

In summary, the No Project alternative would result in less efficient power generation at MBPP, less efficient local, state, and regional transmission and distribution of electricity, and greater environmental impacts, due to either increased demand on older power plant facilities or development at another existing industrial site or a greenfield site to replace the new power generation planned for MBPP.

5.5 ALTERNATIVE ONSITE CONFIGURATIONS

Special attention was given by Duke Energy to the selection of the onsite location for the Project's new combined cycle units at MBPP. The selected site was determined to be the most appropriate balance of environmental, economic, social and technical factors for the MBPP site and the Morro Bay community. Based on the space required for a 1,200 MW combined-cycle facility (i.e., approximately 8 acres) and its location near key existing onsite infrastructures (e.g., natural gas pipeline, cooling water intake and discharge lines, site support facilities, and the PG&E Morro Bay Switchyard), the onsite tank farm area provides the only area on MBPP suitable for the Project (see Figure 5-1). Within the onsite tank farm, four alternative configurations of the 1,200 MW combined-cycle facility were considered as shown in Figure 5-2. The following criteria were used to evaluate these configurations:

- Maintain consistency with local plans and policies, including:
  - Mitigation of visual impacts, with particular emphasis upon views of Morro Rock from Highway 1 and high-use visitor areas.
  - To the extent practical, making the new development subordinate to the character of its setting and visually compatible with surrounding areas.
- Improve views from adjacent residences, views from the Embarcadero and views of the Morro Bay inlet area from the Cuesta residential hillside area.
- Provide a minimum area of 615 feet by 910 feet for 1,200 MW of generating capacity, given the existing MBPP infrastructure and based on using combined-cycle technology.
- Minimize length of connections to key onsite infrastructure, such as the once-through cooling system and the PG&E switchyard.
- Reduce local noise impacts, to the extent practicable and to meet the City of Morro Bay guidelines.
- Use good engineering and utilities practices.

In selecting an onsite location for the new combined cycle units, Duke Energy first evaluated siting limitations imposed by the California Coastal Commission. Duke Energy's property just north of Morro Creek is designated as an area not suitable for power plant expansion or development. Consequently, the recreational vehicle (RV) park and baseball field areas are not suitable locations for the new units. This restriction fits with Duke Energy's own desire to maintain a buffer between onsite activities and adjacent commercial, recreational and residential land uses. The area that serves as this buffer starts north of Morro Creek with the RV park and baseball field areas, continues along Highway 1 just behind the existing PG&E switchyard, and includes an open space area just south of the MBPP main power building adjacent to Scott Avenue and the Veterans Memorial Building (see Figure 5-1). City and County plans encourage use of such natural buffers for

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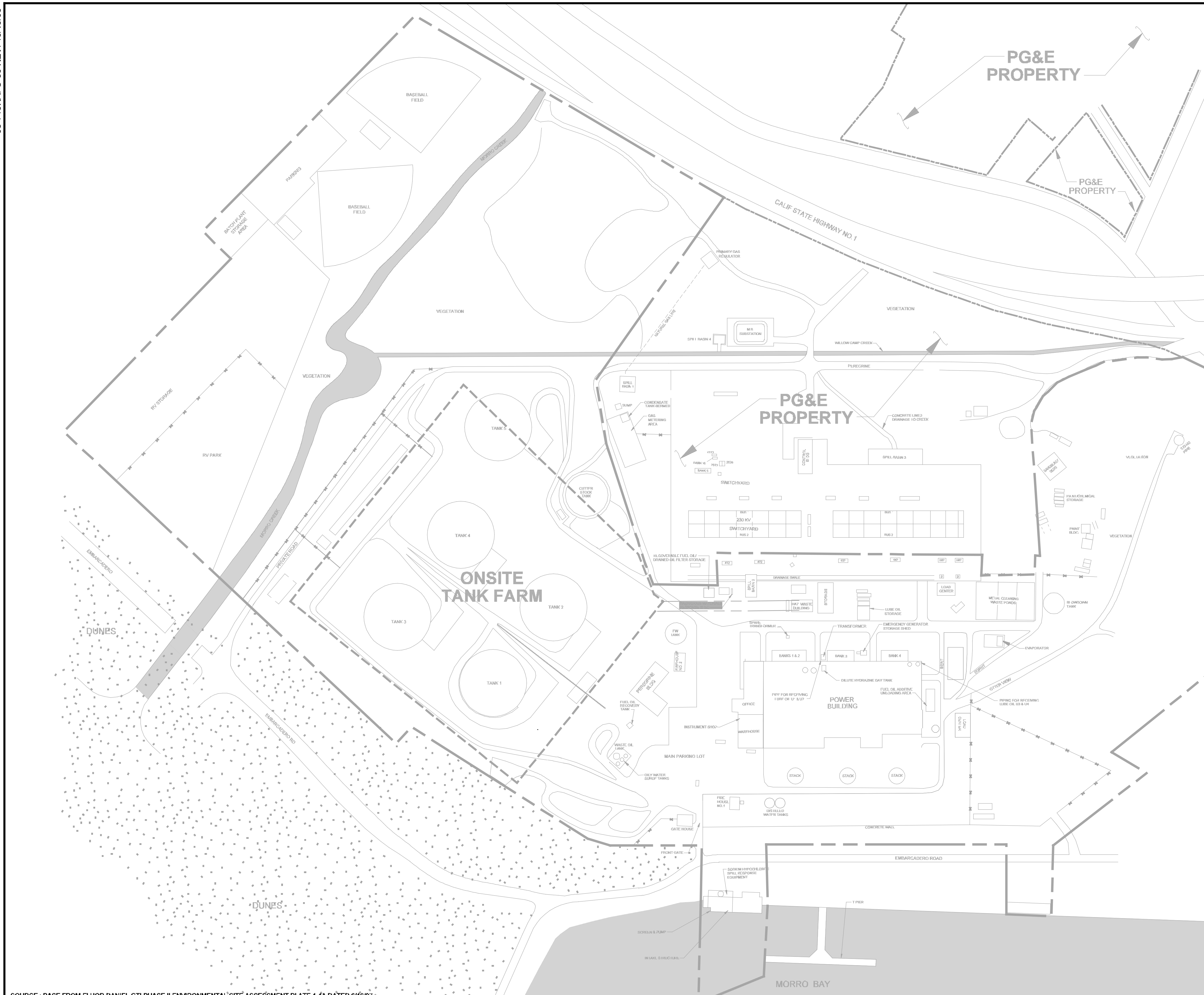


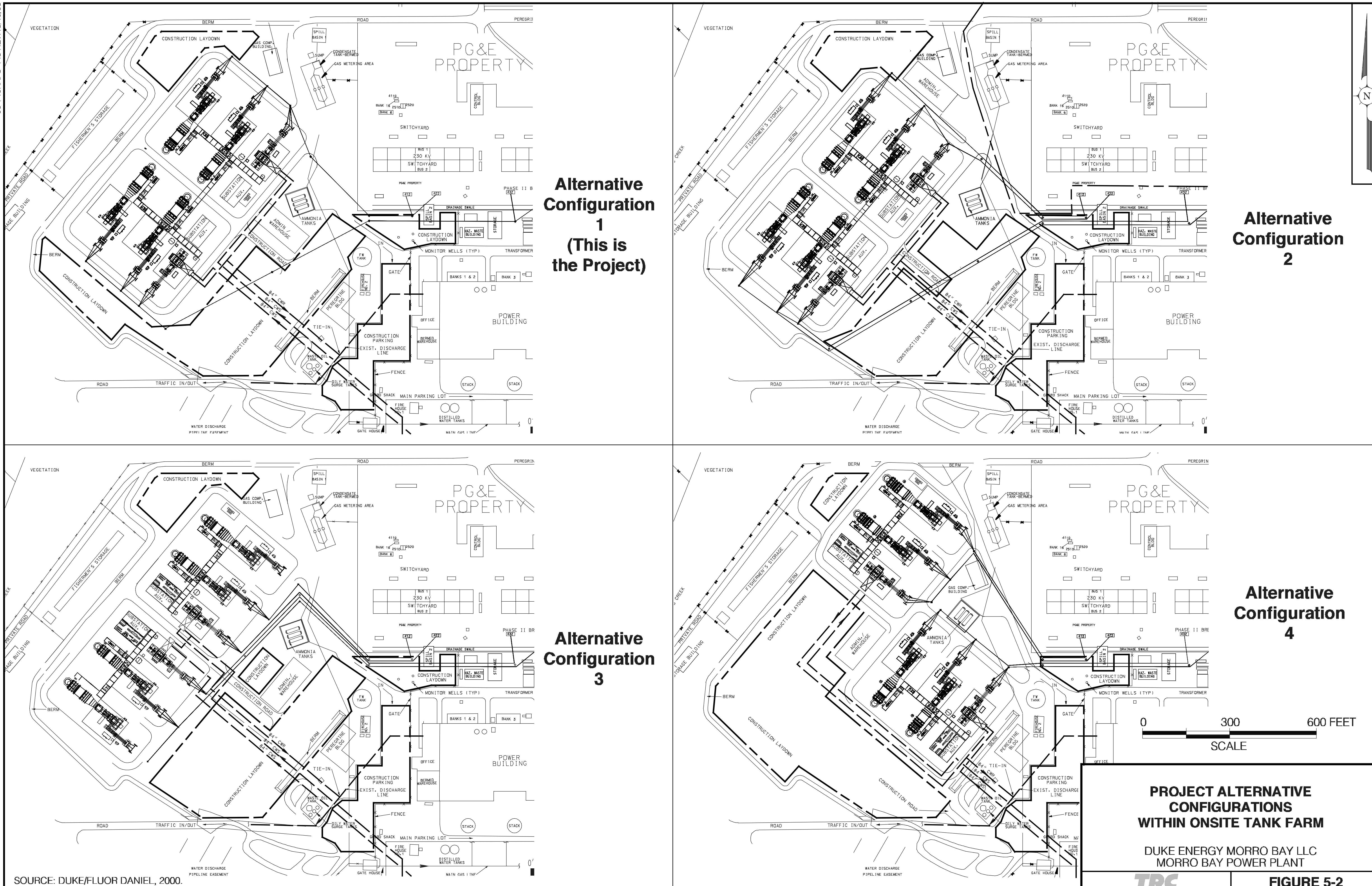
SITE MAP

DUKE ENERGY MORRO BAY LLC
MORRO BAY POWER PLANT

TRC

FIGURE 5-1

98-710RAFC-148 REV.10/19/00



SOURCE: DUKE/FLUOR DANIEL, 2000.

PROJECT ALTERNATIVE CONFIGURATIONS WITHIN ONSITE TANK FARM

DUKE ENERGY MORRO BAY LLC
MORRO BAY POWER PLANT

TRC

FIGURE 5-2

industrial facilities. For these reasons, the area south of the existing power building, and the areas adjacent to the tank farm and PG&E switchyard, were not considered for locating the new combined cycle units.

No other absolute siting restrictions were found in state, county or local laws and policies. Instead, various environmental conditions especially related to visual impacts and access to the beach area were found in the City of Morro Bay General Plan and Local Coastal Plan. These conditions fit with Duke Energy's desire to establish as much consistency with the character of the local setting as possible, with particular emphasis upon views of Morro Rock. Further, though not mentioned in local plans or policies, an effort was made by Duke Energy, when considering the actual arrangement of the new units, to narrow the industrial profile by placing the stacks towards the center of the property and to place the HRSGs perpendicular to the coastline.

Finally, the other engineering-related criteria listed above were each considered and weighed against one another to obtain an optimum onsite location from a technical viewpoint. The results are summarized in the following paragraphs.

5.5.1 ALTERNATIVE CONFIGURATIONS

Four configurations within the onsite tank farm area were evaluated for the Project (see Figure 5-2): (1) the new units perpendicular to each other (the configuration selected as the Project as defined by this AFC); (2) stacks back to back, plant configuration perpendicular to the coast (shift to northern most section of the tank farm); (3) stacks in a row, perpendicular to the coast; and (4) stacks back to back, plant configuration perpendicular and parallel to the coast to form two sides and the corner of a square.

Alternative Configuration 1

Alternative Configuration 1 in the Project as defined by the AFS. As shown in Figure 5-2, this configuration is sited as far north and east as possible to open up views to the ocean, Morro Rock and Estero Bay. This configuration is able to best use the existing berms and landscaping to provide a visual buffer of the Project, and it uses an east to west orientation and the existing berms to act as a buffer for noise. Finally, Alternative Configuration 1 moves the combined cycle units for the Project the farthest from the Embarcadero.

For the above reasons, Alternative Configuration 1 has been selected as the configuration for the Project as it best meets the requirements of Duke Energy and the community as they relate to the orientation of the Project at MBPP.

Alternative Configuration 2

This configuration is similar to Alternative Configuration 1, but is located approximately 100 feet farther west within the onsite tank farm (see Figure 5-2). While this configuration has similar advantages as Alternative Configuration 1, it is closer to Estero Bay and would be more visible from the Embarcadero. This Configuration, however, would very effectively meet the requirements of Duke Energy and the community as they relate to the siting of the new units at MBPP.

Alternative Configuration 3

Alternative Configuration 3 is situated as far north and east as possible to open up views to the ocean, Morro Rock and Estero Bay. Its primary difference from Alternative Configuration 1 is that the four, 145-foot-tall stacks for the new units are aligned vertical to the coastline rather than having the stacks clustered in the center of the new units as for Alternative Configurations 1 and 2 (see Figure 5-2). Alternative Configuration 3 is not as effective in using the existing berms to act as a visual buffer for the new units.

Alternative Configuration 4

This final alternative configuration offsets the new units (see Figure 5-2). While it provides the easiest access to the existing PG&E Switchyard, it was found by Duke Energy not to be as visually acceptable from the Embarcadero.

5.6 ACCELERATED REPLACEMENT OF THE MORRO BAY POWER PLANT SITE (THE PROJECT)

The MOU between Duke Energy and the City Council of Morro Bay contemplated an extensive replacement period for the existing power plant facility. Phase I was to be installed by June 2003, while Phase II would be installed by 2010, with the demolition of the existing facility no later than 3 years after the installation of Phase II.

The phased construction of each 600 MW combined cycle unit separated by a period of years created an interim or transitional operation wherein both portions of the new and old facility were operating simultaneously. The City evaluated these interim conditions and identified numerous disadvantages:

- The view would include both the new and the old facility.
- The air quality benefits in emission reductions would be delayed.
- The reduction in cooling water use would be delayed.
- The construction period would extend over approximately 13 years.
- Potential reuse of the property would be delayed.
- The existing power building and stacks would be visible for an additional 6 or 7 years.

At the strong urging of the City of Morro Bay, Duke Energy carefully considered the possibility of a single replacement project where a 1200 MW facility will be constructed all as part of a single construction phase, and then within an accelerated timeframe the existing power building and the three 450-foot-tall stacks for Units 1 through 4 would be demolished. In June 2000, in response to requests by the City of Morro Bay to shorten the construction time frame, Duke Energy agreed to the single phase Project with replacement and demolition expected to be completed by 2007. This has the immediate advantage of reducing environmental impacts sooner and dramatically shortening construction effects. Cooling water and air emissions and visual improvements occur quickly. In addition fuel savings are also very important as the cost of natural gas has risen significantly in the past year.

5.7 NEW UNITS STRUCTURE ALTERNATIVES

As part of its consideration of whether there are reasonable alternatives to the Project that offer substantial environmental advantages, Duke Energy considered whether to enclose the new units in a complete building, a partial building or no building at all. The three options are shown in Figure 5-3. While any of the above options would be an advantage over the existing plant and would open up the view across the site, the low minimized buildings have been selected as an excellent trade-off to reduce rear views visual clutter associated with an industrial site while still allowing excellent distant views.

Each alternative structure was found to have its own advantages. Duke Energy selected the partial building for the new units for the following reasons:

- **Visual Impacts -** The MBPP's long-term operating history lead to an inclination to completely enclose the facility given its long-term familiarity with an enclosed facility at MBPP and the obvious maintenance advantages of such an approach. However, the complete enclosure was found to block views of Morro Bay and Morro Rock more than necessary. Discussion next centered on the low profile buildings and no-building options. The no-building option offers the least impacts on views of Morro Rock and Morro Bay. But a disadvantage of no-building option is that it has more of an "industrial" look due to the exposed equipment. The partial building, by contrast, has smoother lines and is less "industrial" looking, which was found to be more pleasing to the eye. In addition, as can be seen in Figure 5-3, the low profile does not impact views of Morro Rock and Morro Bay much more than the no-building option. Consequently, on balance, it was found that the partial building offers the best visual features for the surrounding areas.

- **Noise Impacts -** Intuitively, one would expect the no-building option to be louder than the low profile and complete building options. This is in fact the case. For this reason, the no-building option was disfavored from a noise viewpoint, given the proximity of private residences to MBPP. Attention was then focused on whether the noise advantages of the complete structure were so great that they could justify this option despite its visual impacts (see discussion above). After careful consideration and noise modeling, it was found that the insulated low profile buildings in combination with a sound wall on the north side of the plant provides sufficient noise reductions so that the full enclosure was not needed. As a result, the low profile buildings were found to provide the best balance of noise control versus visual impacts and was selected.

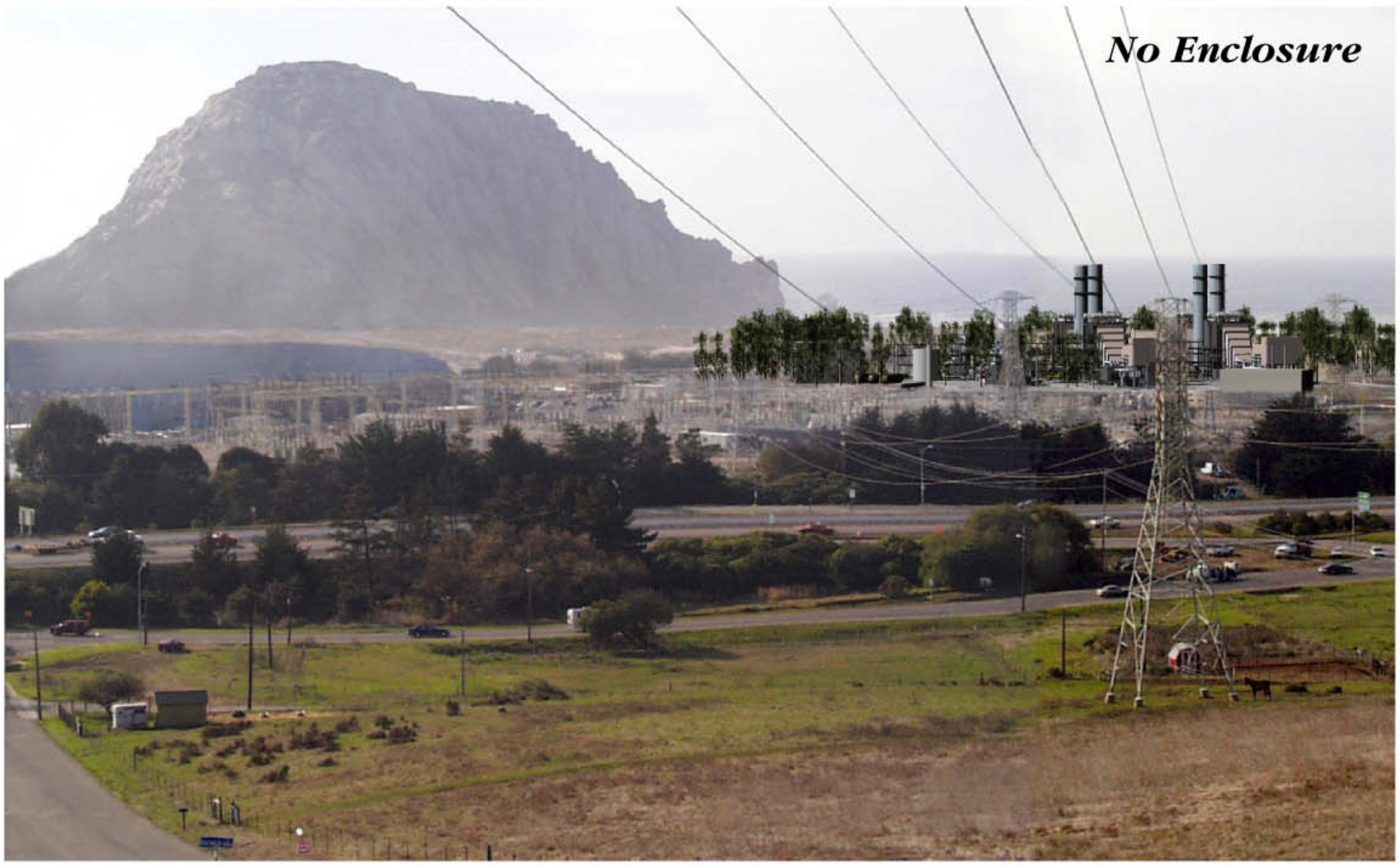
In summary, Duke energy has proposed the insulated low profile building alternative for the new units because it: (1) minimizes impacts on views of Morro Rock and Morro Bay; (2) reduces the "industrial" look onsite; and (3) helps to control noise impacts in the area. The complete structure and no structure alternatives were found to offer no special environmental advantages relative to the partial structure, and potential operational or economic advantages of these two alternative structures were outweighed by the environmental benefits (especially visual) of the partial structure.

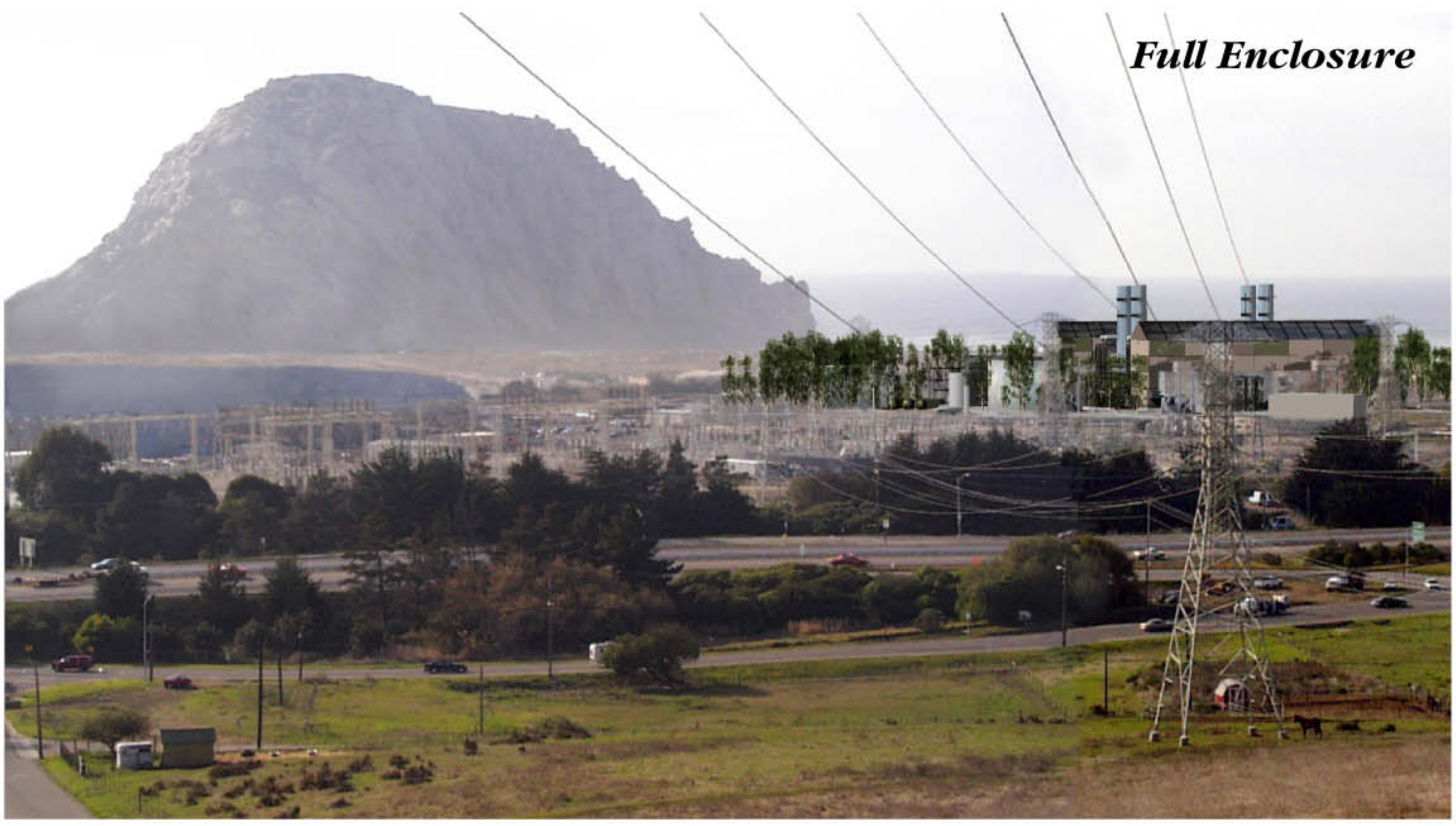
5.8 ALTERNATIVE COOLING TECHNOLOGIES

This section describes cooling system alternatives, which could be used in lieu of, or in addition to, the existing once-through seawater cooling system at MBPP. Each of the alternatives listed below has been evaluated using the criteria listed in Table 5-2. Based on a technical evaluation, each of these alternatives was eliminated from further consideration because of infeasibility, adverse impacts to key environmental concerns, and higher costs to consumers due to reduced plant efficiency and greater fuel consumption.

Alternatives considered included:

- Mechanical draft cooling tower.
- Natural draft cooling tower.
- Air-cooled condenser.
- Cooling ponds.
- Once-through-cooling technology alternative.
  - Variable speed pump motors.
  - Lower Delta T (temperature change) to 15° F.
  - Offshore cooling water discharge relocation.
  - Discharge plume diversion jetty.
  - Offshore cooling water intake relocation (two alternates).
  - Modifications to existing intake structure (inclined traveling screens or fish return system).





ALTERNATIVE
NEW UNITS BUILDING STRUCTURES

DUKE ENERGY MORRO BAY LLC
MORRO BAY POWER PLANT

TRC

FIGURE 5-3

SOURCE: DUKE-FLUOR DANIEL AND EDAW, 2000.

TABLE 5-2

EVALUATION CRITERIA FOR COOLING ALTERNATIVES

- Availability of required resource (e.g., fresh water) without adverse environmental impacts or other unacceptable secondary effects.
- Available space within reasonable proximity to new units.
- Incremental benefits relative to incremental costs.
- Incremental environmental emissions, discharges, and noise.
- Visual impacts.

The City of Morro Bay expressed concerns over alternatives to the proposed continued (though diminished) use of once-through seawater cooling. Specifically, the City requested additional information on obtaining cooling water from sources outside Morro Bay. Also, the City requested information regarding the use of reclaimed water and alternative onsite cooling technology. This section addresses those questions, concerns, and information requests. Table 5-3 summarizes the results of the cooling water alternatives evaluation.

5.8.1 MECHANICAL DRAFT COOLING TOWER

This alternative would replace the once-through seawater cooling water system with a recirculating cooling water system and mechanical draft cooling towers. Figure 5-4 presents a schematic flow sketch of a mechanical draft cooling tower system. With this scheme, warm water from the steam turbine condensers and other cooling water uses in the new combined cycle units would flow to new cooling towers consisting of air-water contact surfaces and electric motor-driven fans. The circulating water to be cooled falls from the top through the tower where it contacts a high airflow drawn through the tower by the fans. Cooling occurs primarily though partial evaporation of the falling water (similar to the operation of a "swamp" cooler). Cooled water collects in a large basin beneath the tower where cooling water circulation pumps return the water to the condensers and other users to repeat the cycle.

Circulating water is lost from the process principally in two ways: evaporation from the tower and a "blowdown" (purge) stream. The blowdown stream is intentionally withdrawn from the circulating water stream to prevent the buildup of dissolved solids since the solids do not evaporate in the tower. A third minor loss consists of liquid water droplets (drift) entrained with the air and water vapor leaving the top of the cooling tower. These losses must be replenished by adding replacement water ("makeup") to the system.

TABLE 5-3
SUMMARY OF RESULTS

ALTERNATIVE	ADVANTAGES COMPARED TO ONCE-THROUGH COOLING	DISADVANTAGES COMPARED TO ONCE-THROUGH COOLING
Mechanical draft cooling tower	Decreased seawater usage with potentially reduced entrainment, impingement, and thermal discharge	• Significant visual impacts. • Potential increased noise. • Drift fallout, increased PM_{10} emissions. • Reduced plant efficiency. • Potential highway safety issues. • Significant expansion of footprint. • High Cost.
Natural draft cooling tower	Decreased seawater usage with potentially reduced entrainment, impingement, and thermal discharge	• Very significant visual impacts. • Drift fallout, increased PM_{10} emissions. • Reduced plant efficiency. • Potential highway safety issues. • Significant expansion of footprint. • High Cost.
Air-cooled condenser	Eliminates seawater use for cooling.	• Significant visual impacts. • Significant expansion of footprint. • Potential increased noise. • Substantially reduced plant efficiency. • High Cost.
Cooling ponds	Decreased seawater usage with potentially reduced entrainment, impingement, and thermal discharge.	• Not feasible without significantly expanding existing MBPP property and land use.
Variable speed pump motors	Decreased seawater usage with potentially reduced entrainment and impingement.	• No significant advantage over proposed multiple cooling water pumps.
Offshore cooling water discharge relocation	Reduce thermal impact at Morro Rock.	• Otherwise unnecessary offshore and onshore construction impacts. • Disruption during construction of heavily used park area. • Reduction, but probably not elimination of thermal impacts at Rock. • Very high cost.

TABLE 5-3
SUMMARY OF RESULTS
(Continued)

ALTERNATIVE	ADVANTAGES COMPARED TO ONCE-THROUGH COOLING	DISADVANTAGES COMPARED TO ONCE-THROUGH COOLING
Discharge plume diversion jetty	Reduce thermal impact at Morro Rock.	• Significant visual impacts. • Reduction, but probably not elimination of thermal impacts at Rock. • Public safety concern. • Navigation hazards. • Creation of new habitat with potentially greater thermal impacts. • Additional Cost.
Offshore cooling water intake relocation (two alternates)	Eliminate Morro Bay entrainment and impingement impacts.	• Otherwise unnecessary offshore and onshore construction impacts. • Disruption during construction of heavily used park area. • Permanent new industrial facilities in park areas. • Very high costs. • Questionable entrainment and impingement benefits.
Modifications to existing intake structure (inclined traveling screens or fish return system)	Reduce impingement impacts.	• Questionable survival improvement. • New permanent and temporary impacts to Morro Bay habitat. • Additional Cost.

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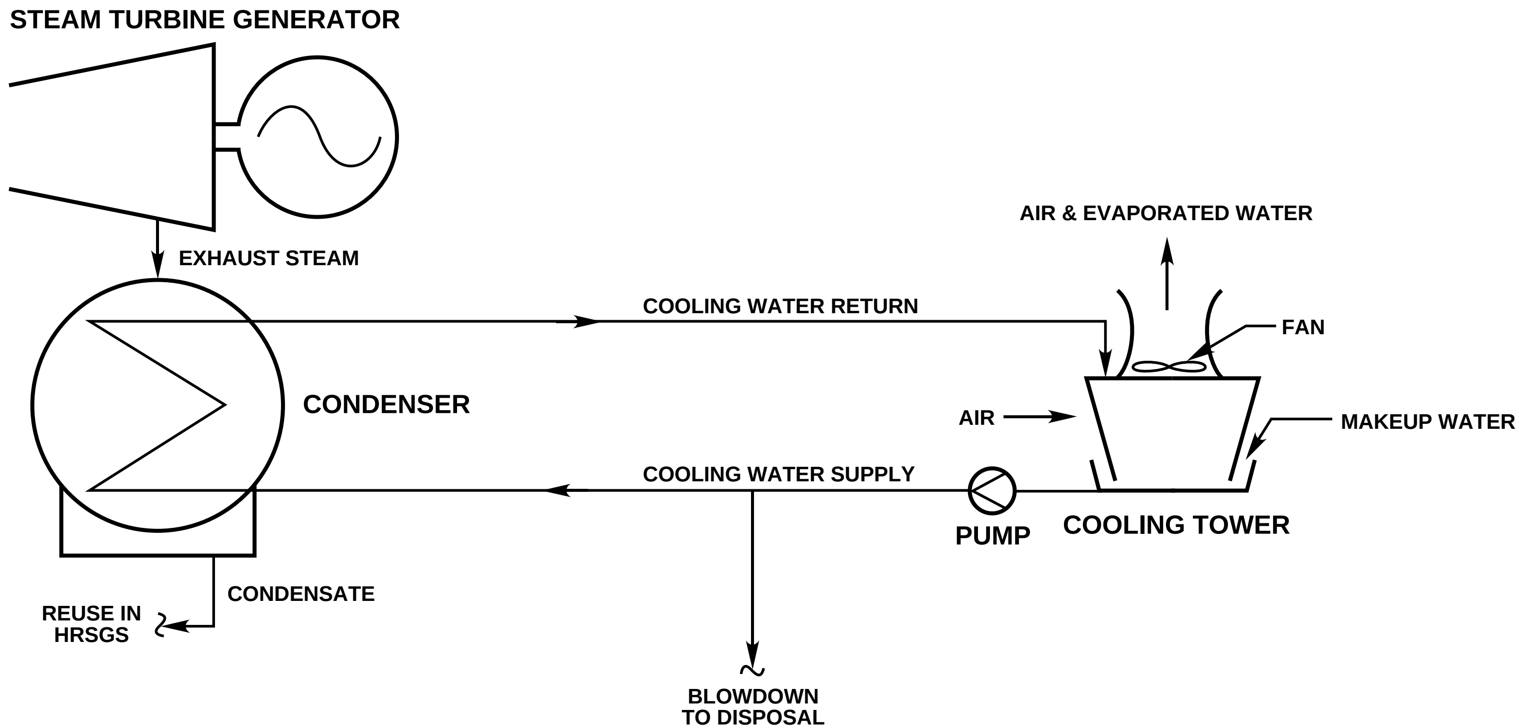

NOT TO SCALE

MECHANICAL DRAFT COOLING TOWER

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FIGURE 5-4

Three hypothetical sources of circulating cooling water potentially exist at the Morro Bay site: ground water (fresh water), reclaimed water from municipal sewage treatment, or seawater. Although fresh water systems have the advantage of smaller makeup water requirements due to lower dissolved solids, a continuous fresh water makeup supply of about 6,000 to 10,000 gallons per minute (gpm) would be required for a fresh water cooling tower system to serve the new combined cycle units. Because of existing and expected future limitations of fresh water supply in the area, Duke Energy decided that a fresh water system was not realistic.(2)

Recent discussion with the local publicly owned treatment works (POTW) located nearby MBPP indicated that, on average, the total treated effluent from the facility is about 1,400 gpm, clearly much less than would be needed for cooling tower makeup (City of Morro Bay, 2000*)*. In addition, there are no firm plans for any significant expansion of this facility. Thus, it was concluded that this alternative is not feasible.

Therefore, the only remaining source of makeup water for a circulating cooling system at the MBPP is the sea. A seawater mechanical draft cooling tower system for the new MBPP combined cycle units would consist of two structures approximately 500 feet x 50 feet x 50 feet high. Considering the necessary separation that must be maintained between the towers and other structures to prevent recirculation of saturated air, this system would occupy a total plot area of at least 100,000 ft^2. Ocean water makeup for the system would be supplied from new pumps at the existing Units 1 through 4 intake structure. The circulating water and blowdown stream would contain salinity (dissolved solids) approximately 50 percent greater than local seawater. The estimated full capacity flow rates for this system are:

- Circulating water 330,000 gpm
- Blowdown 9600 gpm
- Makeup 6,000 to 10,000 gpm

The blowdown stream would contain residual concentrations of biocides, dispersants and other conditioning chemicals, probably in higher concentrations than the existing once-through cooling water discharge.

(2) Fresh water supplies are so limited in the area that demineralized water for feedwater is currently provided (and will continue to be provided) by a seawater evaporation system, instead of groundwater.

A significant negative aspect of mechanical draft cooling towers as compared to the proposed base case of once-through seawater cooling is the decrease in net power output and operating efficiency of the new units. The combination of higher steam turbine condenser pressure caused by the higher cooling water temperature and higher plant electrical load compared to a once-through cooling water system would decrease the net power output by more than 52 MW (for the same fuel consumption). This reduction in capacity would have to be made up either by designing a larger plant with increased duct firing and, therefore more emissions, or by other, probably less efficient and more polluting power sources located elsewhere. With the recent increase in natural gas prices, this will have an adverse affect on the cost of electrical power to the California consumer.

Absent expensive anti-plume devises, visible fog plumes could be expected (probably frequently during the winter) due to condensation in the atmosphere of the considerable amount of water vapor emitted from the top of tower. These plumes would constitute a visual impact in addition to bulk of the tower structure itself and could affect visibility on surrounding streets and highways during certain wind conditions.

Also, cooling tower drift "raining" from the plume could cause a nuisance liquid deposition on the surrounding area (potentially including nearby residences) and increased equipment maintenance requirements. Drift also would lead to increased fine particulate emissions from the facility in the form of dissolved solids emitted with the drift droplets. Assuming drift is 0.00025 percent of circulating water, the estimated additional particulate emissions to the atmosphere associated with drift would be about 495 pounds per day (lb/day).(3)

Further, due to the large fans required and associated very high air flows, cooling towers are a significant potential source of overall power plant noise impacts on surrounding areas.

In summary, the mechanical draft recirculating cooling system would result in the following adverse impacts as compared to the once-through cooling system:

- Visual impacts of the cooling tower structure and condensed exhaust plumes.
- Drift deposition within the plant and nearby properties plus increased emissions of particulate matter due to dissolved salts in the drift.
- Occasional reduced visibility on nearby streets and highways with associated safety concerns.
- Reduced electricity generation efficiency.
- Significant land use.
- Potential noise impacts.

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(3) Based on about 5 percent dissolved solids in the circulating water.

For these reasons, the proposed once-through cooling water system is preferred to a mechanical draft cooling tower.

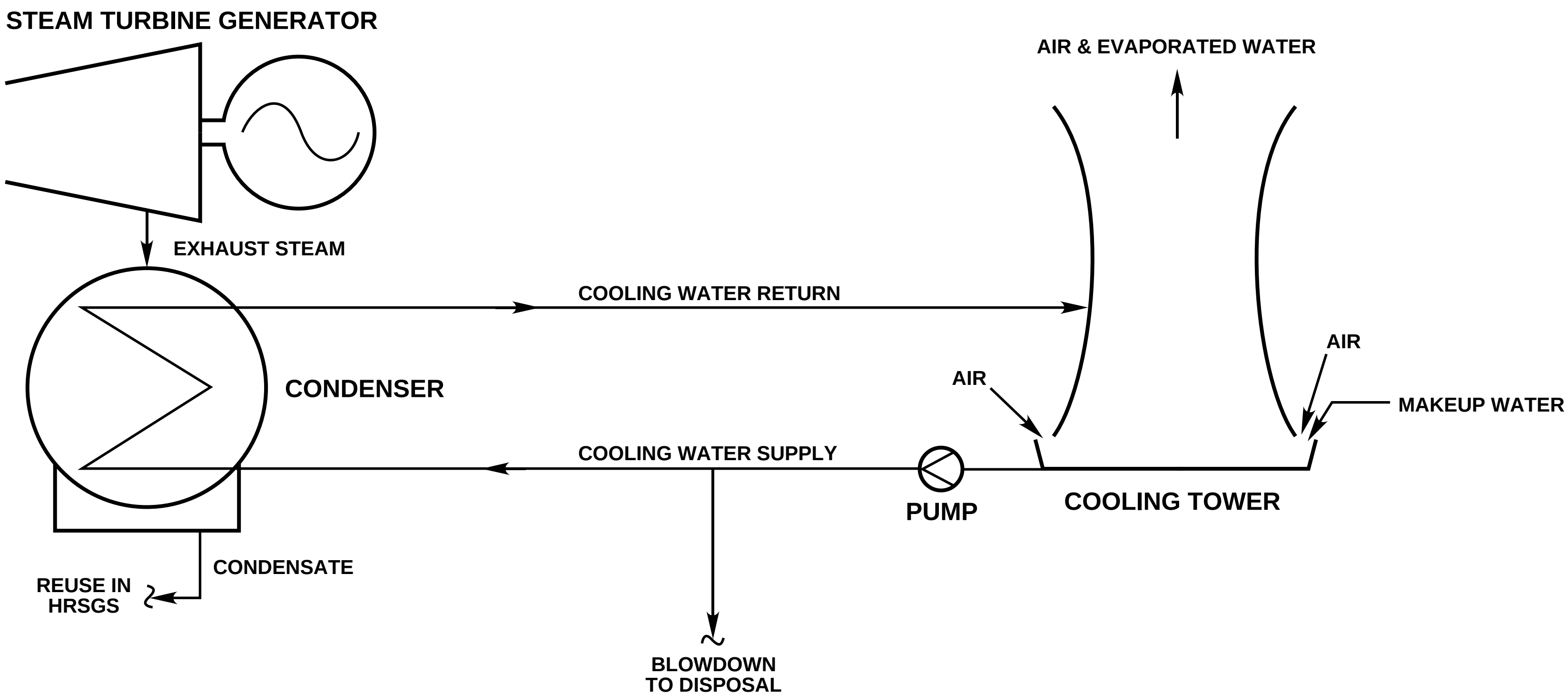
5.8.2 NATURAL DRAFT COOLING TOWER

A natural draft cooling tower system is similar in principal to the mechanical draft system. The primary difference is that the mechanical fans to move the cooling air are replaced by what is essentially a very large chimney. Figure 5-5 show a schematic flow sketch for this type of cooling system. Air is drawn in at the base of the tower due to the less dense (more buoyant), warmer air exiting the top of the tower. This natural air circulation contacts the returned cooling water inside the tower and cools the water, mainly by evaporation. As a result, the cooling water recirculation, blowdown, and makeup rates and quality would be similar to the mechanical (forced draft) system.

A natural draft cooling tower to serve the new MBPP combined cycle units would be at least 250 feet in diameter at the base and about 400 feet in height. The use of such a cooling tower is not as efficient as once-through cooling and increases the amount of natural gas required for a given level of electrical generation capacity. This alternative was eliminated based on the adverse visual impacts of such a massive structure and space constraints at the site, in addition to the secondary economic and environmental costs mentioned for mechanical draft cooling towers above.

5.8.3 AIR-COOLED CONDENSER

In an air-cooled condenser system, exhaust steam from the steam turbine generator is cooled and condensed in a large external heat exchanger, using atmospheric air as the cooling medium. Figure 5-6 presents a flow schematic for an air-cooled condenser. Large, electric motor-driven fans move large quantities of air across finned tubes (similar in principle to an automobile radiator) through which the exhaust steam is flowing. Heat transfer from the hot steam to the air cools the steam, which condenses and is returned to the steam cycle. The now warmer air is exhausted to the atmosphere.



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NATURAL DRAFT COOLING TOWER

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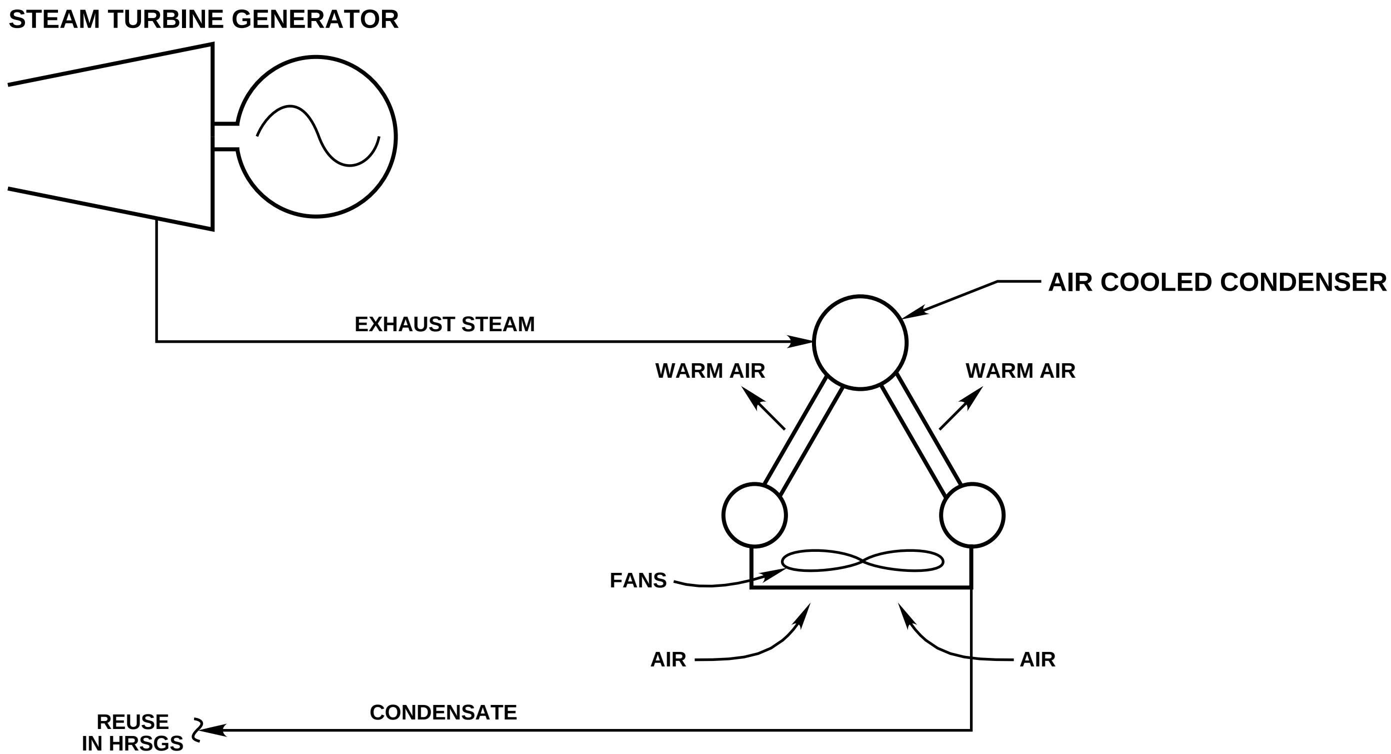
FIGURE 5-5



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AIR COOLED CONDENSER

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FIGURE 5-6

Air-cooled condensers for power plants are very large structures that consume significant amounts of power for the fans. They also significantly reduce steam turbine output due to higher condensing temperatures compared to once-through or recirculating water condensers. It is estimated that an air-cooled condensers for the new MBPP combined cycle units, one for each unit, would each occupy about 0.8 acre, extend to a height of 90 feet, and in total reduce the new plant electrical output by at least 76 MW (the size of a small power plant). The small power plant would likely not be a efficient as the Project and would require more natural gas than if once-through cooling is used at Morro Bay and have a very adverse affect on the cost of power to the California consumer. Air–cooled condensers can also increase plant noise levels. Due to these factors, the air-cooled condenser option was eliminated from additional consideration.

5.8.4 COOLING PONDS

Cooling ponds are sometimes used to dissipate heat from thermal power plants. This option would consist of constructing a large earthen, probably lined, water pond from which cooling water could be circulated to and from the plant condensers. Heat is lost from the pond through radiation and convection to the surrounding air.

The use of cooling ponds is normally limited to plant sites with significant amounts of excess space. It is estimated that a cooling pond system for the new Morro Bay combined cycle units would require more than 300 acres of plot space to adequately cool the circulating water. Obviously this will not work on a site that contains only about 140 acres (including the PG&E switchyard). Therefore, this option is eliminated from further review.

5.8.5 VARIABLE SPEED PUMP MOTORS

This alternative would consist of replacing the fixed-speed electric motor drives for the eight new combined cycle cooling water pumps with variable speed motors (or two-speed motors), rather than with conventional fixed speed motors as currently proposed. Variable speed motors could be used to reduce cooling water flow rates as power production is varied in response to hour-by-hour changes in load requirements. Sufficient flow would be maintained to ensure that the cooling water temperature rise remains within the applicable National Pollutant Discharge Elimination System (NPDES) discharge temperature limit.

The potential benefit of reduced flows is reduced entertainment and impingement of marine organisms. Reducing cooling water flows at reduced loads would decrease intake water volume and water velocity at the traveling screens proportionately and, therefore, under lower operating levels reduce entrainment and impingement. The tradeoff is that the cooling water discharge temperature would remain relatively constant during load variations, and the potential marine environmental benefit of reduced discharge temperatures during less than full load operation would be diminished.

Since the new combined cycle units will be provided with four cooling pumps each, the reduced cooling water usage benefits of variable speed motors can be accommodated simply by taking one or more of the multiple fixed speed pumps off line at reduced loads. This approach eliminates the unnecessary extra investment and complexity of installing variable speed pumps while obtaining similar environmental benefits. As described in Section 6.5 - Water Resources, it is expected that each new unit will operate with three pumps during nonsupplemental (duct) firing operation, which will be the most common operating mode.(4) Therefore, the alternative of variable speed pumps is discarded from further consideration.

5.8.6 LOWER DELTA T (TEMPERATURE) TO 15° F

This alternative would lower the cooling water discharge temperature from the Project design level of 20° F to 15° F. The advantage of the approach is that it would lower the Project's cooling water discharge temperature into Estero Bay. The disadvantage of this approach is that it would increase the amount of sea water used at MBPP, which would increase impingement and entrainment effects. Since cooling water discharge temperature effects are considered not significant and entrainment effects are more critical (see Section 6.6A - Marine Biological Resources), the alternative of designing the Project to a cooling water discharge temperature level of 15° F was rejected.

5.8.7 COOLING WATER DISCHARGE RELOCATION

This alternative consists of moving the cooling water discharge from its existing shoreline location to a point offshore to reduce potential shoreline thermal impacts. Based on the thermal plume studies performed by PG&E in 1973, when MBPP was operating at a thermal discharge level similar to (or probably greater than) expected Project operations, it is estimated that the cooling

(4) Figure 6.5-2, included in Section 6.5 - Water Resources of this AFC, graphically presents a comparison of cooling water flows over the range of generating loads for both the existing units and the new units equipped with multiple pumps.

water outfall could be extended 3,000 feet offshore to significantly reduce potential shoreline temperature. This alternative would require the following changes to the Project:

- Combine two of the three existing cooling water discharge tunnels into a single 12-foot-diameter discharge pipe at the point where the existing tunnels terminate at the existing outfall channel adjacent to Morro Rock.
- Extend this new 12-foot-diameter concrete discharge line through the existing outfall channel to a new outfall point, 3,000 feet offshore to the northwest, at a depth of at least 35 feet below the water surface. This new offshore line would be laid in an excavated trench that would partially cover the pipe.
- Install a vertical discharge riser at the termination of the new undersea discharge line.

The location of the alternative discharge line is shown in Figure 5-7.

The very high environmental and engineering costs associated with the relocation of the cooling water discharge makes this alternative infeasible. In addition, aboveground facilities in the vicinity of the public use areas associated with Morro Rock and the public beach would be required.

The very high cost of relocation of the discharge cannot be justified based on the following. The speed and direction of ocean currents in Estero Bay vary widely with tide and wave induced gravitational flow, wind and along shore transport. Even at the offshore distance of the proposed relocation, the discharge plume would be expected to contact the inshore beach under certain late summer and early winter conditions. Vertical mixing of the discharge as it rises from the bay floor would minimize, but not eliminate, the possibility of a thermal plume shoreline contact. Although the potential biological effect of this plume is less due to its lower temperature, effective reduction of effects on beach habitat and biological communities is negligible. Since the existing shoreline plume temperature poses no thermal risk, moving the discharge does provide some benefit to a small fraction of Morro Rock's algae community.

The necessary length of the offshore discharge increases the travel time for entrained organisms, further reducing their chances to survive through the cooling water system. Any small benefit to Morro Rock's algae would be outweighed by this increase in potential cooling water system effects on entrained fish and shellfish. Historic and ongoing studies of the cooling water discharge on biological communities have shown no significant adverse effects, and have concluded that all beneficial uses are protected. See Section 6.6A - Marine Biological Resources for information on these evaluations.

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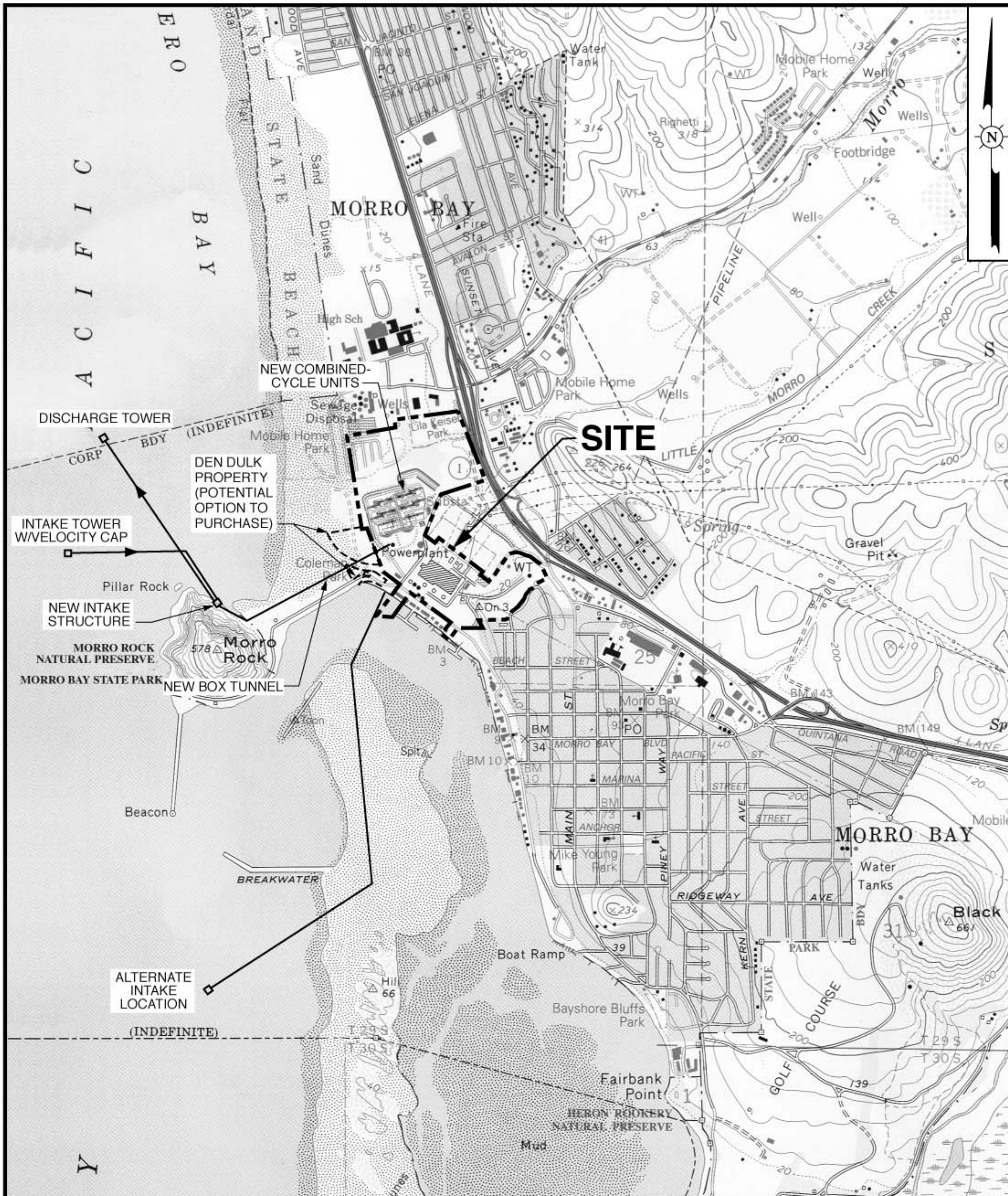

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REFERENCE: USGS 7.5 MINUTE TOPOGRAPHIC MAP OF MORRO BAY NORTH AND MORRO BAY SOUTH, CALIFORNIA, DATED 1993 AND 1994.

ONCE-THROUGH COOLING WATER INTAKE AND DISCHARGE - ALTERNATE LOCATIONS

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FIGURE 5-7

As a result of the above reasons, this alternative was eliminated from further consideration.

5.8.8 DISCHARGE PLUME DIVERSION JETTY

The purpose of this alternative is to reduce potential thermal effects on biological communities of Morro Rock shoreline which result from the present cooling water discharge location at the base of Morro Rock. This alternative would consist of constructing an in-water, "riprap" jetty (with some type of low permeability filler) extending northward several hundred feet into the water at a point just west of the discharge channel. This jetty would deflect the discharge plume into Estero Bay, away from the shoreline rocks at the base of Morro Rock. Figure 5-8 conceptually shows the plume diversion jetty.

Although this new jetty could reduce some of the thermal discharge exposure along the shoreline, it has several significant disadvantages:

- Significant adverse visual impacts in a heavily visited scenic area.
- The plume could "wrap around" the jetty during north-south current flow, thus reestablishing the shoreline thermal exposure that the jetty is intended to reduce.
- Public safety issues regarding a new navigation hazard and potential risks to unauthorized persons venturing onto the structure.
- Building a jetty introduces a significant degree of environmental and engineering complexity. It would create new habitat, and it is unclear whether there would be an effect on this new habitat because of the thermal discharge, or whether the thermal effects on this new habitat might be greater than the effects on the existing habitat at the Morro Rock shoreline. There would also be questions about the complex interaction of the new jetty with the Morro Rock shoreline.
- With the jetty in place, the orientation of the thermal plume would expose more of the sandy beach habitat of Estero Bay to the discharge than is presently the case.
- Significant adverse impacts to the shoreline during construction of the new jetty.

For the above reasons, this option was eliminated from further consideration.

5.8.9 OFFSHORE COOLING WATER INTAKE

Two alternate offshore cooling water intake locations were evaluated for the new combined cycle units to avoid potential entrainment and impingement of organisms from Morro Bay. To minimize

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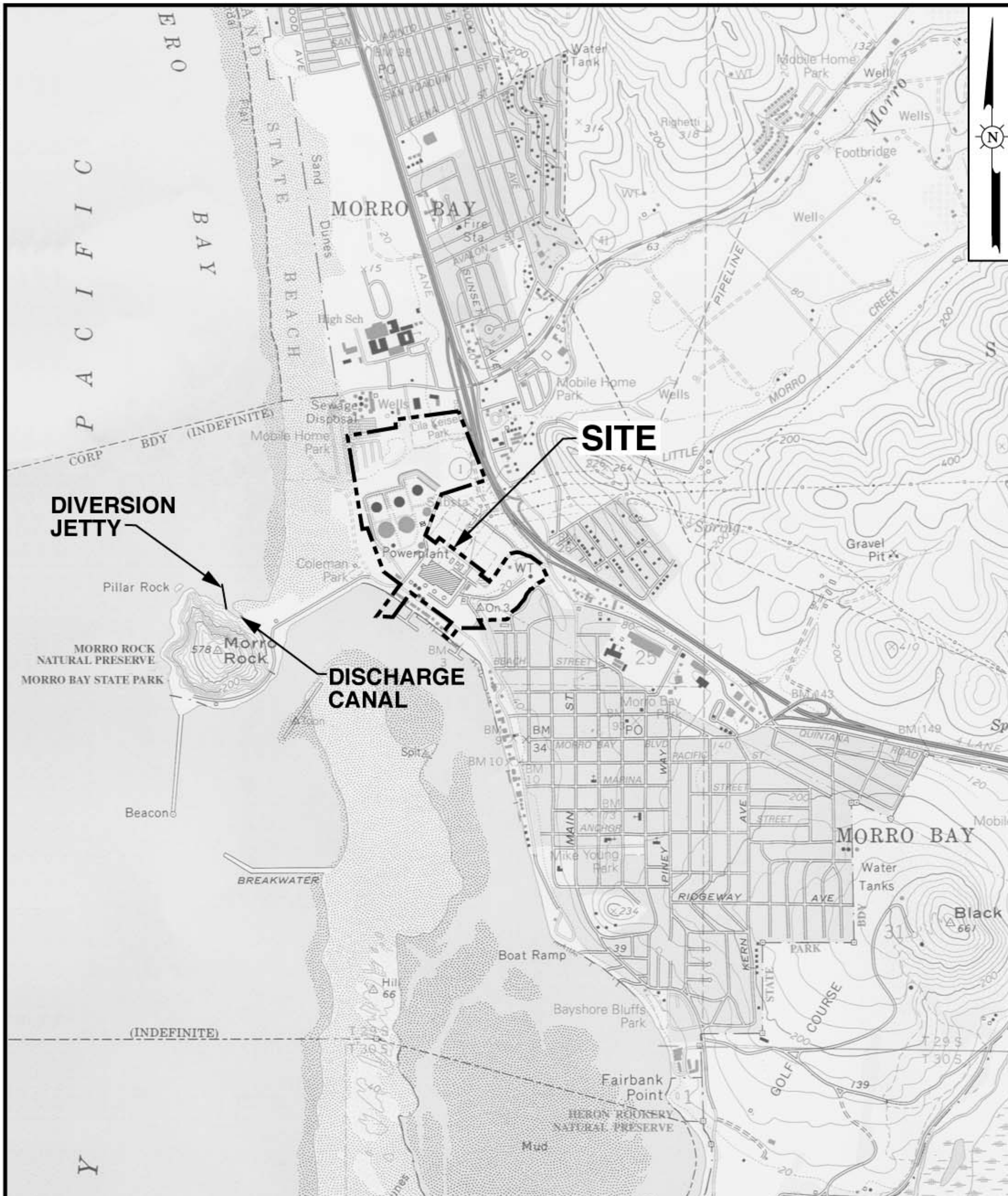

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SCALE: 1: 24,000

REFERENCE: USGS 7.5 MINUTE TOPOGRAPHIC MAP OF MORRO BAY NORTH AND MORRO BAY SOUTH, CALIFORNIA, DATED 1993 AND 1994.

COOLING WATER DISCHARGE PLUME DIVERSION JETTY ALTERNATIVE

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MORRO BAY POWER PLANT

TRC

FIGURE 5-8

any potential future effects Morro Bay organisms, it was decided to evaluate a new cooling water intake location in Estero Bay, north of Morro Rock and a second location outside the breakwater, south of the harbor entrance.

The first cooling water intake alternative would consist of abandoning the existing Units 1 through 4 intake structure and constructing a new intake system in and adjacent to Estero Bay. Additional modifications for this alternative would include the following:

- Installation of two new 10-foot-diameter undersea cooling water intake lines along the route of a new offshore discharge line described above. These new lines would extend from a point in Estero Bay about 1,000 feet offshore, at a depth of about 30 feet below the water surface, to the shoreline at the base of Morro Rock. If the offshore cooling water discharge line is not installed (i.e., the existing shoreline discharge channel remains as is within the Project), then the new intake lines would extend an additional 1,000 feet west so that the new intake point would be located well away from the thermal effects of the discharge plume.
- Construction of a new intake structure immediately onshore in the vicinity of the existing discharge structure. This new structure would contain the new cooling water pumps for the combined cycle units, a bar rack debris barrier, new inclined traveling screens with screen wash system, and cross-connections to the adjacent discharge line, with slide gates to facilitate periodic heat treating. A fish return system could be installed in lieu of inclined screens, consisting of a fish collection basket at the base of vertical traveling screens and a sluiceway that would return the collected fish and other organisms to the bay.
- Installation of two new, approximately 8-foot-diameter onshore, underground cooling water supply lines (or equivalent cross-sectional area tunnel) extending from the cooling water pumps in the new intake structure to the combined cycle units, generally following the route of the existing underground cooling water discharge tunnels.

The second alternative location of the cooling water intake would also be in Estero Bay, south of the Morro Bay entrance breakwater and west of the sand spit separating Morro and Estero Bays. This alternative would consist of installing two new 10-foot-diameter intake lines from the existing Units 1 through 4 intake structure in Morro Bay which would extend under the bay to the sand spit, continue underground on the sand spit to point directly east of the southern breakwater, and extend offshore into Estero Bay for a distance of about 1,000 feet to the new intake location. These new intake lines would be tied into the existing Units 1 through 4 intake structure which would contain the new cooling water pumps for the combined cycle units. The locations of the both alternative cooling water intake lines are shown in Figure 5-7.

The very high costs of these alternatives and the environmental impacts of their construction could only be justified by the need for mitigation of significant adverse impacts. For the first alternative, relocating the intake structure to the base of Morro Rock would mean adding industrial facilities in a heavily used public park area. Obtaining construction permits and easements would be a formidable task due to the sensitive nature of this park location. Construction of the new onshore underground cooling water supply lines would cause temporary disruption to local tourist traffic at Morro Rock and to public use of the beach. Construction of the offshore lines would cause additional impacts.

Similar difficulties exist for the second location, plus the impacts of underwater construction in the harbor and installation of new large-diameter underground lines on the environmentally sensitive sand spit.

Relocation of the combined-cycle intake to an offshore location would not avoid the entrainment of fish and invertebrates. Impingement of endemic Morro Bay species would be nearly eliminated. However, larval stages of these species would still reach the intake, born by tidal flows out of Morro Bay. Based on experience from other offshore intakes along the California coast, overall impingement rates would be higher with an offshore intake than with the existing intake. Given the ubiquitous nature of species entrained and impinged at the present location, and the relatively small reduction in entrainment of Morro Bay water, this costly intake structure relocation cannot be justified. An offshore intake would have adverse environmental consequences in that entrainment affects on commercial fish and other marine species would be significantly increased.

The increased length of travel time for large fish entrapped by the offshore intake would have no chance of surviving impingement. This is an impact that is not associated with the current system. At the existing shoreline intake location, entrapment potential is minimal, and healthy juvenile and adult fish freely move in and out of the intake structure. Therefore, an offshore intake structure will have an adverse impact on commercial fisheries.

For the reasons stated above, this alternative is eliminated.

5.8.10 ADDITIONAL MODIFICATIONS TO INTAKE STRUCTURE

This alternative would consist of using the existing Units 1 through 4 intake structure to serve the new combined cycles units with modifications to potentially reduce impacts to marine organisms. This would involve extending the Units 1 through 4 intake structure approximately 12 feet into the bay to provide sufficient additional room to accommodate either a new 60-degree inclined traveling screen system or a new fish return system (with vertical screens), similar to that described for the relocated intake structure.

Duke Energy believes that the relative improvements in impingement related to either of these alternatives, requiring intake structure modifications, do not outweigh the impacts of constructing a large intake structure that extends into Morro Bay. Extension of the existing intake structure into Morro Bay could create additional navigation hazard for local boat traffic as well as remove a small portion of bay habitat.

The entrapment potential of the existing intake facility is so low that there might be an increase in the entrapment from a deeper intake forebay that would offset any reduction in impingement rates. Impingement rates are already relatively low compared to other power plants, and reduced intake volumes at Units 1 through 4 will reduce intake approach velocities further lowering the potential for impingement. Fish return systems are sometimes not effective in reducing impingement losses depending on the species involved, their size, and other factors. Species of fish that are the most commonly impinged, anchovy for example, are the least likely to survive impingement and return systems. The discharge point for fish return systems can attract predators and scavengers which essentially eliminate any chances for a returned fish to survive long-term.

Therefore, this alternative is eliminated from further consideration.

5.9 ALTERNATIVE GENERATING TECHNOLOGIES

The purpose of considering alternative generating technologies is to determine if any of the technologies could offer substantial environmental advantages over the natural gas-fired combined cycle unit. It should be noted, however, that a large percentage of new electric power generation proposed in California is combined-cycle because of its efficiency and relatively low environmental impacts. For convenience, the combined-cycle technology is described first. Each technological alternative is then briefly presented, followed by a comparative analysis (summarized in Table 5-1) and conclusions.

5.9.1 CONVENTIONAL COMBINED-CYCLE GENERATING TECHNOLOGY

This technology integrates combustion turbines and steam turbines to achieve greater efficiencies than most other power generating technologies. The combustion turbine, which drives a generator, would normally exhaust its hot combustion gas to the atmosphere. But, with combined-cycle technology, the exhaust gas is routed through a steam generator or boiler to recover additional energy, creating steam that is used to drive a steam turbine/generator. The resulting efficiency is 52 to 55 percent, considerably greater than most other technologies. This greater efficiency results in low air emissions per kilowatt hour of electrical energy produced and relatively low cost. In addition, natural gas fuel emits little sulfur dioxide and little particulate matter. In this revised Morro Bay AFC, supplemental firing is being included with the combined-cycle technology so that when demands are high additional generation is available.

This technology is commercially available and can be implemented. For these reasons, the combined-cycle system is considered the benchmark against which other technologies are compared in this AFC.

5.9.2 ALTERNATIVE TECHNOLOGIES

Alternative generating technologies reviewed below are organized according to their applicability to the MBPP site (e.g., geothermal power facility could not simply be added to the MBPP site due to the absence of geothermal resources in the immediate site area) and their commercial availability. Consequently, Section 5.9.2.1 describes technologies that are feasible for implementation at MBPP as true alternatives to the combined cycle unit. Section 5.9.2.2 briefly describes additional technologies that were considered but rejected for this analysis. For convenience, the technologies are grouped according to the fuel used: oil and natural gas, coal, nuclear reactions (usually using radioactive materials as fuel), water (hydrothermal, ocean conversion, geothermal), biomass, municipal solid waste and solar radiation.

5.9.2.1 Alternative Technologies Considered for Implementation at MBPP

5.9.2.1.1 Oil and Natural Gas

These technologies use oil or natural gas and include conventional boiler-steam turbine units, combustion turbines in various configurations, and fuel cells.

Conventional Boiler-Steam/Turbine. With this technology, fuel is burned in a furnace/boiler to create steam, which is passed through a steam turbine that drives a generator. The steam is then condensed (cooled) and returned to the boiler. Although this technology is commercially available and could be implemented, it is only able to achieve a relatively low maximum thermal efficiency on the order of 35 to 40 percent. Due to its relatively low efficiency, it tends to emit a greater quantity of air pollutants per kilowatt hour of power generated than more efficient technologies. Furthermore, its cost of generation is relatively high, depending upon the source of fuel (coal, oil, natural gas, municipal solid waste, etc.), making it unable to economically compete with other natural gas-fired alternatives. The existing MBPP Units 1 through 4 are conventional boiler-steam/turbine technology and absent the proposed modernization can continue to operate for the indefinite future.

Supercritical Boiler/Steam/Turbine. This technology is basically the same as the conventional boiler-steam/turbine except that considerably higher pressures are employed. While this technology is more efficient, it requires more expensive materials to construct the units. Consequently, although it is more efficient than the conventional boiler-steam/turbine technology, it is considered less desirable than the proposed combined cycle unit due to higher costs to construct and lower efficiencies than the proposed combined cycle unit. Moss Landing Units 6 and 7 employ super critical boiler technology and are expected to remain in service for the indefinite future.

Simple Combustion Turbine. This technology uses a gas or combustion turbine to drive a generator. Air is compressed in the compressor section of the turbine, then passed into the combustion section where fuel is added and ignited. The hot combustion gases then pass through a turbine, which drives a generator and the compressor section of the turbine. Air quality impacts can be higher for these units, especially for large-scale power generation. This is because of very high exhaust gas temperatures, making it difficult to control nitrous oxide (NO_x). Nevertheless, simple combustion turbines are relatively low in capital cost and have efficiencies approaching 40 percent in larger units. Because they are fast-starting and have a relatively low capital cost, they are used primarily for meeting high peak demand (about 1,000 to 3,000 hours per year), where their relatively low efficiency is of less concern due to higher marginal electricity prices.

Although this technology is commercially available and could be implemented, due to its relatively low efficiency, potential limited run hours and higher electricity generation cost, it was not considered further. Also, it tends to emit a greater quantity of air pollutants per kilowatt hour generated than more efficient technologies and, if it were base-loaded, its cost of generation would be relatively high.

Cogeneration. Cogeneration systems have been designed and built for many different applications. Large-scale systems can be built onsite at a plant, or offsite. Offsite plants need to be close enough to a steam customer (or municipal steam loop) to cover the cost of a steam pipeline. There are no nearby industrial facilities that could serve as a steam customer. Therefore, Duke Energy decided to continue operation of MBPP as an "electricity only" facility.

5.9.2.2 Technologies Considered but Rejected From Further Review as Alternatives

5.9.2.2.1 Oil and Gas

Kalina Combined-Cycle. This technology is similar to conventional combined-cycle except water in the heat recovery boiler is replaced with a mixture of water and ammonia. Overall efficiency is expected to be increased 10 to 15 percent. This technology is still in the testing phase, however, with tests recently completed on a 3 MW unit in southern California. This technology is not commercially available.

Advanced Gas Turbine Cycles. There are various efforts to enhance the performance and/or efficiency of gas turbines by injection of steam, intercooling, and staged firing. These include the steam injected gas turbine (SIGT), the intercooled steam recuperated gas turbine (ISRGT), the chemically recuperated gas turbine (CRGT) and the humid air turbine (HAT) cycle. The SIGT is marginally commercially available, but its efficiency is lower than conventional combined-cycle technology. The other three technologies are not commercially available.

Fuel Cells. This technology uses an electrochemical process to combine hydrogen and oxygen to liberate electrons, thereby providing a flow of current. The types of fuel cells include phosphoric acid, molten carbonate, solid oxide, alkaline, and proton exchange membrane. With the exception of the phosphoric acid fuel cell, and possibly the molten carbonate fuel cell, none of these technologies is commercially available. The phosphoric acid fuel cell has operated in pilot-scale units, and the molten carbonate fuel cell has completed testing. At this time, however, neither technology is cost competitive with conventional combined-cycle technology nor designed on a scale necessary to satisfy the demand requirements of the state.

5.9.2.2.2 Coal

Technologies that use coal for fuel include conventional furnace/boiler steam turbine/generator, fluidized bed steam turbine/generator, integrated gasification combined-cycle, direct-fired combustion turbine and indirect fired combustion turbine. There are no coal burning electrical generating facilities in California with generating capacity comparable to MBPP. In addition, public perception about air pollution from coal facilities and the lack of ready access to coal by train/truck from out of state make this fuel source largely infeasible. Finally, the lack of an available freight-rail line to Morro Bay, even if the coal were available, creates a prohibitive transportation improvement cost factor for any use of coal technology. Given these constraints, coal is not an acceptable fuel for use at MBPP.

Conventional Furnace/Boiler Steam Turbine/Generator. With this technology, coal is burned in the furnace/boiler, creating steam that is passed through a steam turbine connected to a generator. The steam is condensed in a condenser, passed through a cooling tower and returned to the boiler. The efficiency of this technology is equivalent to a conventional gas/oil fired steam turbine/generator unit (35 to 40 percent) and, because of the usually lower price of coal compared to natural gas, the technology may be cost-competitive, particularly for base-load facilities. Because of the lower efficiency of this process, however, air emissions per kilowatt hour generated are greater than for a conventional combined-cycle process.

Atmospheric and Pressurized Fluidized Bed Combustion. These two technologies burn coal in a hot bed of inert material containing limestone that is suspended or fluidized by a stream of hot air from below. Water coils within the furnace create steam that drives a steam turbine/generator. The combustion chambers of pressurized units operate at 150 to 250 pounds per square inch gauge (psig) to increase efficiency. The efficiencies of atmospheric fluidized bed combustion (AFBC) units are on the order of 35 to 40 percent and for pressurized units (pressurized fluidized bed combustion [PFBC]), efficiencies are between 40 and 45 percent.

The AFBC technology is commercially available, at least up to the 160 MW size. The PFBC technology is not commercially available. Implementation of the AFBC technology in California is possible, particularly for cogeneration applications (several new units have recently been constructed). However, the coal would have to be imported from outside California, resulting in increased train and/or truck traffic. Also, the generation cost of this technology could be greater than for a combined cycle unit due to the lack of a commercially proven unit in the 600 MW range.

Integrated Gasification Combined-Cycle. The integrated gasification combined-cycle (IGCC) gasifies coal to produce a medium British Thermal Unit (Btu) gas that is used as fuel in a combustion turbine. The coal gasifier is located at the same site as the combustion turbine, heat recovery steam generator (HRSG), and steam turbine/generator. The coal gasifier is specifically sized to supply the combustion turbine and integrated with it and the rest of the equipment to provide an integrated generating system.

Implementation of the IGCC technology in California is possible except that coal would have to be imported from outside the state. The generation cost of this technology is not competitive with a conventional gas-fired combined-cycle technology.

Direct- and Indirect-Fired Combustion Turbines. Direct-fired units burn finely powdered coal directly in the combustion chamber of the combustion turbine. Indirect-fired units burn the coal in a fluidized bed or other combustor. Both then use a heat exchanger to transfer heat from the combustion gases to air, which is then expanded through the turbine. Neither of these types of units is commercially available.

5.9.2.2.3 Nuclear Reactors

This technology includes nuclear fission and nuclear fusion. Nuclear fission breaks atomic nuclei apart, giving off large quantities of energy. For nuclear fission, pressurized water reactors (PWRs) and boiling water reactors (BWRs) are commercially available. While nuclear fission is a viable base load technology heavily used in France and Japan, it is currently out of favor in the United States, particularly in California. In addition, California law prohibits new nuclear plants until the scientific and engineering feasibility of disposal of high-level radioactive waste has been demonstrated. Duke Energy did not select this technology due to legal, environmental, capital cost and economic viability considerations. Also, Diablo Canyon nuclear facility, owned and operated by PG&E, is already operating in San Luis Obispo County.

5.9.2.2.4 Water

These technologies use water as "fuel," and include hydroelectric, geothermal, and ocean energy conversion processes. There are limited geothermal resources in San Luis Obispo County and none in the immediate site area. Further, hydroelectric facilities, while in existence in other locations in San Luis Obispo County (e.g., Lopez Lake, Lake Nacimiento, Whale Rock Reservoir and Santa Margarita Lake), require much larger land area than is available onsite to generate significant MW of electricity. These requirements make geothermal and hydroelectric facilities infeasible at MBPP, but they are described briefly below for completeness.

Hydroelectric. This technology uses falling water to turn turbines that are connected to generators. A flowing river or, more likely, a dammed river in the mountains or foothills, is required to obtain the falling water. This technology is commercially available. However, most of the sites for hydroelectric facilities have already been developed in California; remaining potential sites face formidable environmental licensing problems. Hydroelectric facilities are not feasible for the Morro Bay area due to lack of usable hydrologic resources.

Geothermal. These technologies use steam or high-temperature water (HTW) obtained from naturally occurring geothermal reservoirs to drive steam turbine/generators. There are vapor dominated resources (dry, super-heated steam) and liquid-dominated resources (LDR) where various techniques are utilized to extract energy from the HTW. Geothermal is a commercially available technology, but it is limited to areas with appropriate geologic site conditions. Even in areas where such conditions are present, there have been issues with the reliability of the steam supply and the corrosiveness of the supply. As there is no known geothermal resources near Morro Bay such an approach is not feasible.

Ocean Energy Conversion. A number of technologies use ocean energy to generate electricity. These include tidal energy conversion, which uses the changes in tide level to drive a water turbine/generator; wave energy conversion, which uses wave motion to drive a turbine/generator; and ocean thermal energy conversion, which employs the difference in water temperature at different depths to drive an ammonia cycle turbine/generator. While these technologies have been made to work, they are not fully commercially available and, in any event, would impact local recreational and fishing activities. For these reasons, these technologies were not selected.

5.9.2.2.5 Biomass

Major biomass fuels include forestry and mill wastes, agricultural field crop and food processing wastes, and construction and urban wood wastes. Several techniques are used to convert these fuels to electricity, including direct combustion, gasification, and anaerobic fermentation. While these technologies are available commercially on a limited basis, their cost tends to be high relative to a conventional combined cycle unit burning natural gas and they therefore were not selected by Duke Energy. In addition, a large biomass facility in Morro Bay could have greater environmental impacts than a combined-cycle power plant.

5.9.2.2.6 Municipal Solid Waste

This technology, commonly referred to as waste-to-energy (WTE), consists of extracting energy from garbage, either by burning or by other means, such as pyrolysis or thermal gasification. The best known methods incorporate mass burn and refuse-derived fuel (RDF) facilities. Both mass burn and RDF are commercially available methods of municipal solid waste (MSW) technology. Other methods are co-firing with coal, using fluidized-bed furnace/boilers, and pyrolysis or thermal gasification. There is only one 10 MW mass burn unit operating in California and no RDF facilities or facilities using the other methods.

The economic feasibility of MSW technology depends heavily on the level of the "tipping fee" for MSW disposal in the vicinity of the generating facility. The tipping fee is the price charged by landfills for depositing waste or garbage in the landfill and is usually expressed in dollars per ton. In effect, a waste collection company would pay the WTE facility for taking and burning its garbage, resulting in a negative fuel cost to the WTE. A recent study for development of a WTE facility in the San Francisco area estimated that the tipping fee would have to be about $80 per ton for a facility to be economic. The current market tipping fee in San Luis Obispo County is about $40 per ton.

5.9.2.2.7 Solar Radiation

Solar radiation (sunlight) can be collected to generate electricity, either directly, with solar thermal and solar photovoltaic technologies, or indirectly, through wind generation technology where sunlight causes thermal imbalance in the air mass, creating wind. These technologies are largely infeasible for the Morro Bay area due to their large land requirements and the lack of consistent sunshine. For example, centralized solar projects using the parabolic trough technology require at least approximately 5 acres per MW; consequently 1,200 MW would require at least 6,000 acres, more than 600 times the amount of space used by the proposed combined-cycle facility. Photovoltaic arrays require similar acreage per MW.

Because centralized wind generation areas generally require 40 to 50 acres per MW, generation of 1,200 MW would require 48,000 to 60,000 acres. This is approximately 5,000 to 6,000 times the amount of space taken up by the proposed project. Wind generation and two types of solar generation, thermal conversion and photovoltaics are nevertheless described below for completeness. The technologies below will require standby power sources when there is insufficient sunlight or insufficient wind.

<u>Solar Thermal</u>. Most of these technologies collect solar radiation to heat water to create steam, then use the steam to power a steam turbine/generator. Most systems that have been used in the United States capture and concentrate the solar radiation with a receiver. The three main receiver types are mirrors located around a central receiver (power tower), parabolic dishes and parabolic troughs.

Another technology collects solar radiation in a salt pond and then uses the collected heat to generate steam and drive a steam turbine/generator.

While one of these technologies might be considered marginally commercial (parabolic trough), the others are still in the experimental stage. They each require considerable land for the collection receivers and are best located in areas of high solar incidence. In addition, solar energy storage capabilities are limited with this technology. These systems are not commercially available and, due to land unavailability in the Morro Bay area, are not implementable.

Solar Photovoltaic. This technology uses photovoltaic "cells" to convert solar radiation directly to direct current electricity, which is then converted to alternating current. Panels of these cells can be located wherever sunlight is available. This technology is environmentally benign and is commercially available, since panels of cells can theoretically be connected to achieve any desired capacity. At the current time, however, the cost is high and not competitive with other forms of energy. Economic infeasibility and insufficient solar incidence made selection inappropriate for use at MBPP.

Wind Generation. This technology uses a wind-driven rotor (propeller) to turn a generator and produce electricity. Only certain sites have adequate wind to allow for the installation of wind generators. MBPP is not one of them. Most potential sites that have not been developed are remote from electric load centers. Capacity from this technology is not always available because, even in prime locations, the wind does not blow continuously. In California, the average wind generation capacity factor has been 25 to 30 percent. This technology is commercially available and probably implementable at certain sites, although financing may not be available due to its perceived risk. This technology also is land intensive, is know to effect raptors, and has noise impacts. Although the cost of wind-generated energy, with the inclusion of federal production tax credits, is somewhat competitive, such low production cost is highly dependent on a very high quality wind resource. Such a resource does not exist within over 100 miles of Morro Bay.

5.10 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section presents a comparative analysis of the alternatives presented. Since the purpose of this analysis is to evaluate if there are feasible alternatives that could avoid or lessen adverse environmental impacts at the MBPP site, the following criteria are used:

- Feasibility - This criteria includes consideration of commercial availability, cost, and operational compatibility.

- Environmental Impacts - The anticipated environmental effects of each technology are reviewed to determine if impacts would be less than, the same or similar, or greater than the proposed technology.

The comparative analysis is presented in Table 5-1. The top row of the table shows the feasibility criteria and environmental criteria for operation of the Project. Below, the comparative analysis shows the feasibility and environmental impact criteria for operating each of the alternatives, including the No Project alternative, alternative onsite locations, alternative generating technologies and alternative cooling technologies. The feasibility criteria reflect independent evaluations of the cost and commercial availability of each alternative, plus its operational compatibility. Criteria for these alternatives are not absolute, but are as they would be compared to the Project. As demonstrated in the table, there is no alternative that is as feasible as the Project. Neither is there an alternative that has less overall environmental impact than the Project.

5.11 CONCLUSIONS

Feasible technologies were reviewed using a methodology that incorporates feasibility and potential environmental impacts. Although some technologies other than the Project (combined-cycle utilizing natural gas) were feasible, most would not result in fewer environmental effects, and some would result in greater environmental effects. In addition, each alternative technology was less cost-effective than the combined-cycle and would therefore not be competitive as a merchant plant in the deregulated California electricity market that became effective April 1, 1998. As a result, it is concluded that the conventional combined-cycle technology using natural gas as fuel is the best available technology and the one that should be employed at MBPP.

5.12 REFERENCES

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